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SPECIAL TEXT  
11-154-2

US  
ARMY



SIGNAL CENTER and SCHOOL

Do Not Sell

SIGNAL REFERENCE DATA

RADIO COMMUNICATION EQUIPMENT

PREPARED BY  
DEPT OF COMMAND COMMUNICATIONS

DEPARTMENT OF THE ARMY  
Headquarters, U.S. Army Signal Center and School  
Fort Monmouth, New Jersey 07703

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Special Text 11-154-2 has been prepared under the supervision of the Commanding General, US Army Signal Center and School. This text is provided for resident and nonresident instruction conducted at the US Army Signal Center and School. It reflects the current thought of this school and conforms to printed Department of the Army doctrine as closely as possible.

Suggestions and criticisms relative to form, content, purpose or use of this text, are invited and should be referred to the Commanding General, US Army Signal Center and School, ATTN: ATSSC-DCL, Fort Monmouth, New Jersey 07703.

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## PURPOSE

This text is a ready source of factual information about radio communication equipment. It is provided to support instruction conducted by the US Army Signal Center and School.

## SCOPE

ST 11-154-2, SIGNAL REFERENCE DATA-RADIO COMMUNICATION EQUIPMENT includes technical data on the signal equipment used by TOE organizations and on developmental equipment. Information presented in this text is current as of November 1970. Refer to DA Pam 310-4, Military Publications, Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.

## SUPERSESSION NOTICE

ST 11-154-2, dated November 1972 supersedes ST 11-154-2, dated January 1971.

## NOTES ON THIS TEXT

1. The information about equipment in this text does not distinguish between models, except in cases where technical characteristics are different. In addition, when more than one model of an equipment exists, only one is illustrated. Detailed information covering differences in models, when required, is provided in the technical manual on the equipment.
2. In some cases, the federal stock number and TM reference number are not available for developmental and recently standardized equipment. The spaces for these items were left blank purposely for you to jot them down as they become available.
3. There is an index at the rear of the text. The equipment is indexed alphabetically by nomenclature type number.

# CHAPTER 1. FREQUENCY MODULATED SETS AND ASSOCIATED EQUIPMENT

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## RADIO SET AN/PRC-6

STATUS: C&T; FSN: 5320-194-9928  
REF: TM 11-296

### GENERAL INFORMATION

The AN/PRC-6 is a compact, low-power, battery-operated, FM radio receiver-transmitter designed for use at squad and platoon levels. It can be operated using the built-in microphone and earphone or an external handset attached to the set. The AN/PRC-6 is being replaced by the AN/PRT-4 and AN/PRR-9.

### TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: 47.0 to 55.4 MHz

Crystals available every 200 KHz (43 chans)

Planning range: 1.6 km

Power output: 0.25 w

Antenna: 2 ft steel tape whip

Power source: Battery, dry BA-270 (BA-2270  
for Arctic use), BA-4270  
(magnesium battery), CX-8281  
special purpose cable assembly  
for cold weather use.

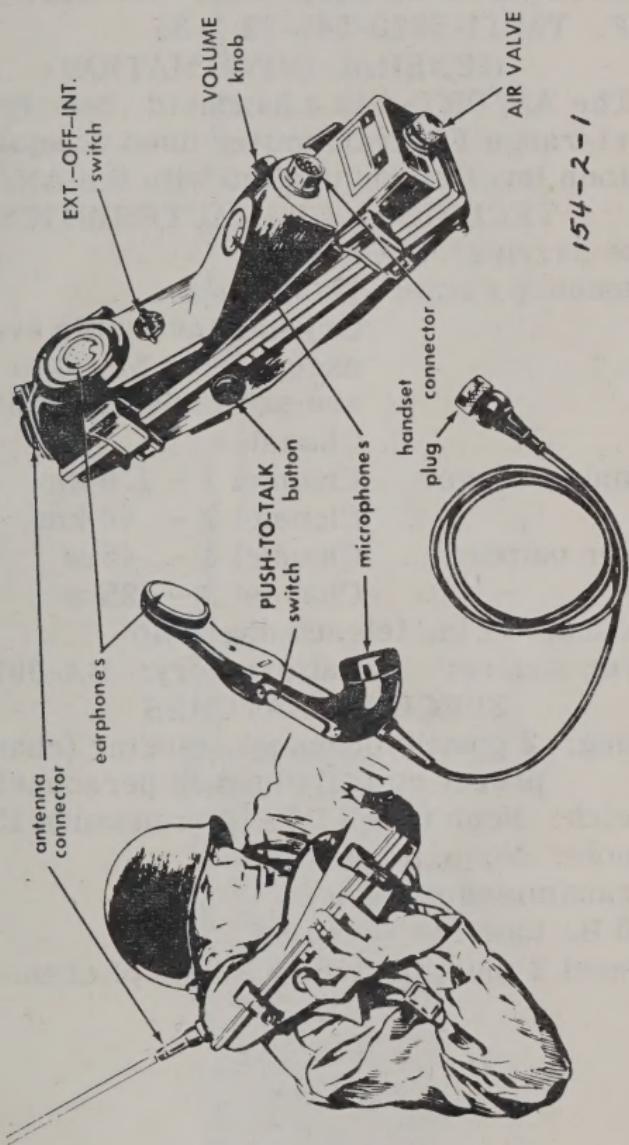
### SPECIAL FEATURES

Tuning: Crystal controlled. Crystals installed by  
maintenance personnel.

Squelch: None

Remote: Using GRA-6

Weight: 5.357 lbs w/battery



# RADIO TRANSMITTING SET AN/PRT-4 AND AN/PRT-4A

STATUS: STD-A; FSN: 5820-868-8107

REF: TM 11-5820-549-12, -35

## GENERAL INFORMATION

The AN/PRT-4 is a handheld, battery-powered, short-range FM transmitter used at squad and Platoon level in conjunction with the AN/PRR-9.

## TECHNICAL CHARACTERISTICS

Type Service: 30F3

Frequency range: 47-57 MHz

Crystals available every 100 KHz except from 51.00 to 51.90, they are available every 50 KHz (110 Chans)

Planning range: Channel 1 - 1.6 km  
Channel 2 - .46 km

Power output: Channel 1 - .45 w  
Channel 2 - .25 w

Antenna: 24 in. telescoping whip

Power source: Battery, dry: BA-399

## SPECIAL FEATURES

Tuning: 2 position channel selector (channels preset by maintenance personnel)

Squelch: None (AN/PRT-4A transmits 150 Hz tone)

Remote: None

Retransmission: None

1200 Hz tone for signaling

Channel 2 must be within 1 MHz of channel 1



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# RADIO RECEIVING SET AN/PRR-9

STATUS: STD-A; FSN: 5820-069-8931

REF: TM 11-5820-549-12, -35

## GENERAL INFORMATION

The AN/PRR-9 is a compact, lightweight battery-powered FM radio receiver designed to be worn on the operator's helmet or on his webbing with an external earphone. It is used at squad and platoon level in conjunction with the AN/PRT-4.

## TECHNICAL CHARACTERISTICS

Type service: 30F3

Frequency range: 47-57 MHz

Crystals available every 100  
KHz except from 51.00 to 51.90,  
they are available every 50 KHz  
(110 Chans).

Antenna: 18.5 inch wire whip (AS-1998)

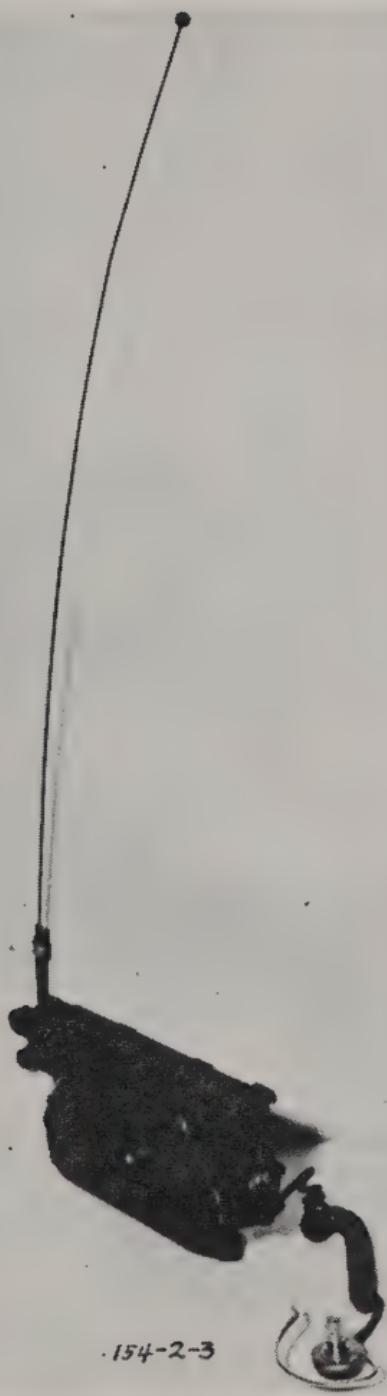
Power source: Battery, dry BA-505

## SPECIAL FEATURES

Tuning: None; frequencies preset by maintenance personnel

Squelch: Carrier (old)

Function switch controls: On-off; volume and squelch.



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## RADIO SETS AN/PRC-8, -9, -10

STATUS: C&T AN/PRC-8 FSN: 5820-665-1217  
AN/PRC-9 FSN: 5820-669-7018  
AN/PRC-10 FSN: 5820-705-9067

REF: TM 11-5820-292-10

## GENERAL INFORMATION

The AN/PRC-8, -9, and -10 are compact low-power, battery-operated, FM radio receiver-transmitters designed for use at platoon and company levels. The AN/PRC-8, -9, -10 are replaced by Radio Set AN/PRC-25 or -77.

## TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: AN/PRC-8, 20-28 MHz

Frequency assigned every 100 kHz (81 chans)  
AN/PRC-9, 27-39 MHz

Frequency assigned every 100 kHz (121 chans)  
AN/PRC-10, 38-55 MHz

### Frequency assigned etc.

Planning range: 8 km

Power output: approx 1 w

3 ft steel tape whip AT-272

Power source: Portable: Battery, dry BA-279/U (BA-2279 for Arctic use)

#### SPECIAL FEATURES

Presets: None

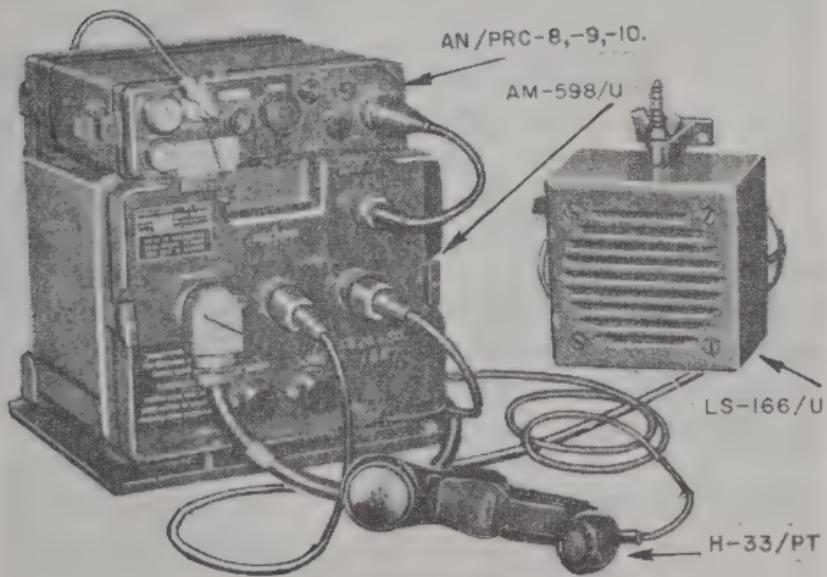
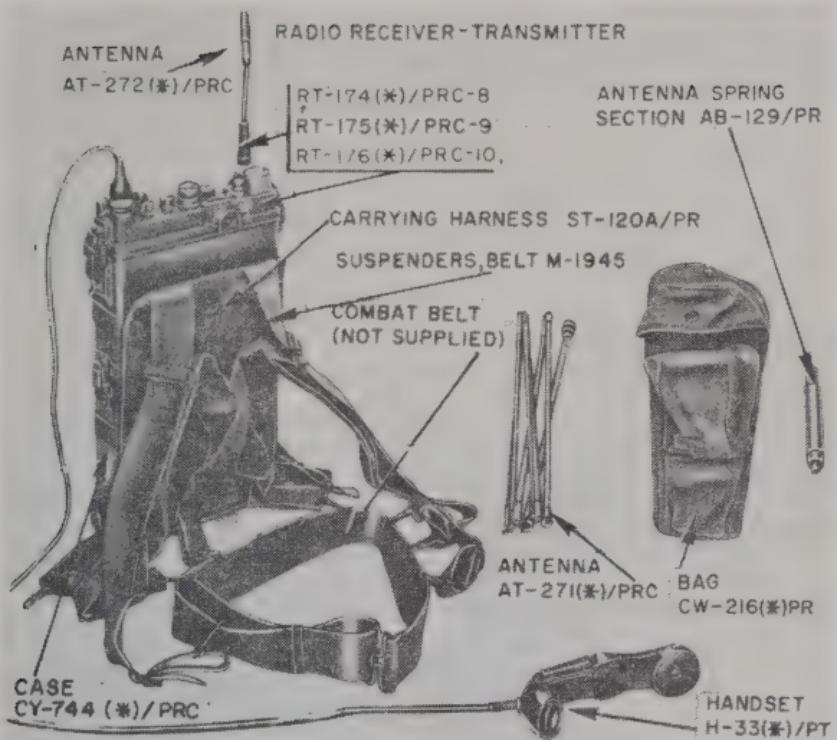
Squelch: Carrier (old)

Remote: 3.2 km using AN/GRB-6

## Mobile: Using AM-598

Weight: 26.08 lbs w/battery.

Tuning: Continuous with calibration every 1 MHz (red lines on "A" Models).



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# RADIO SETS AN/PRC-25, AN/VRC-53 AND AN/GRC-125

STATUS: STD-A; FSN: PRC-25 (Portable)  
5820-857-0759  
VRC-53 (Vehicular)  
5820-086-7586  
GRC-125 (Portable &  
vehicular  
5820-086-7536

REF: TM 11-5820-398-12

## GENERAL INFORMATION

The AN/PRC-25 is a short-range, battery-powered radio set. It can also be used in portable/vehicular, or strictly vehicular configurations, depending upon basis of issue.

## TECHNICAL CHARACTERISTICS

Type of service: 30F3

Frequency range: 30 to 75.95 MHz

Channel every 50 kHz (920 chans)

Planning range: 8 km

Power output: 1.5 w

Antennas: 3 ft steel tape whip (AT-892)

10 ft multisection whip (AT-271A)

10 ft vehicular whip (AS-1729 or AT-912)

Power source: Portable: BA-386, BA-4386,  
BA-398 (Arctic use)

Vehicular: 24 v dc for OA-3633

## SPECIAL FEATURES

Tuning: Detent

Calibration (operator): None

Squelch: Tone (150 Hz called "New")

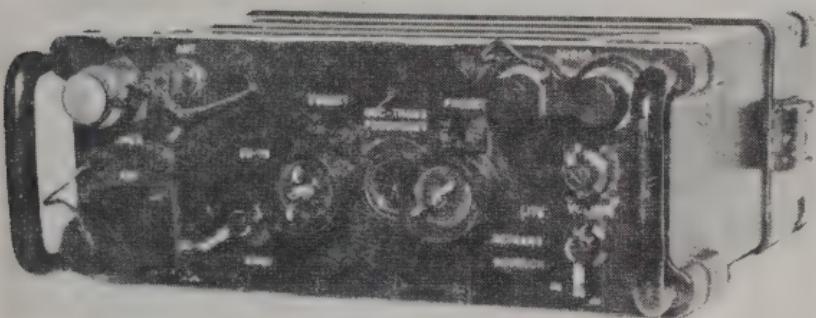
Remote: AN/GRA-39 or GRA-6 w/CX-7474

Retransmission: Using 50 ft retrans cable  
MK-456/GRC

Weight: Portable 23.5 lbs.

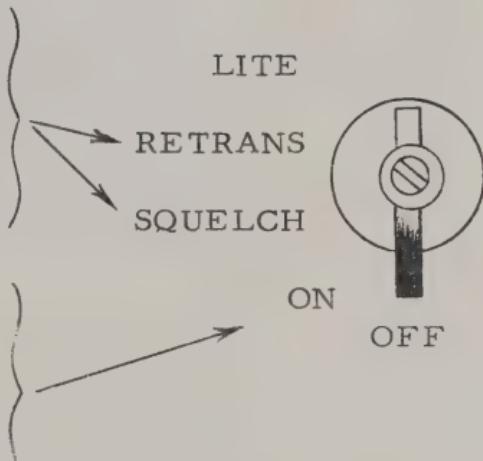
## Configurations

	RT-505	OA-3633	Battery, dry
GRC-125 Port & Veh)	1	1	1
VRC-53 (Vehicular)	1	1	0
PRC-25 (Portable)	1	0	1



An incoming carrier with 150 Hz TONE is required by receiver section to deactivate squelch circuitry. Transmitter 150 Hz oscillator operates when RT unit is keyed.

No squelch operation in receiver section. Transmitter 150 Hz oscillator operates when RT unit is keyed.



RADIO SETS AN/PRC-77, AN/VRC-64,  
AND AN/GRC-160

STATUS: STD-A; FSN: PRC-77 (Portable)  
5820-930-3724  
VRC-64 (Vehicular)  
5820-087-6096  
GRC-160 (Portable/  
vehicular)  
5820-832-4743

REF: TM 11-5820-667-12

GENERAL INFORMATION

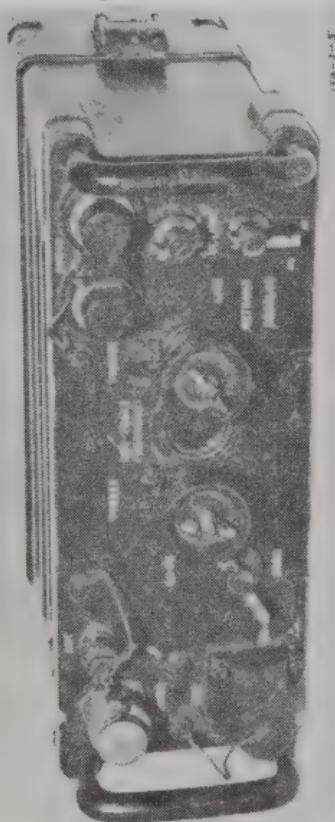
The PRC-77 is identical to the PRC-25 except that it is fully transistorized, has improved re-transmission capability and can provide secure voice (X. MODE) transmission.

TECHNICAL CHARACTERISTICS

Same as AN/PRC-25

Configurations:

	<u>RT-841</u>	<u>OA-3633</u>	<u>Battery, dry</u>
GRC-160 (Port & Veh)	1	1	1
VRC-64 (Vehicular)	1	1	0
PRC-77 (Portable)	1	0	1



## RADIO SETS AN/GRC-3 through -8 SERIES

STATUS: C&T; FSN: (See Appropriate TM)

REF: TM 11-284

### GENERAL INFORMATION

Radio Sets AN/GRC-3 through -8 are short-range, vehicular sets, used within and between armor, artillery, and infantry units. With 5 major components, the AN/GRC-3 through -8 series can make up 24 standard configurations (22 vehicular and 2 ground). This series is replaced by the AN/VRC-12 family of radio sets.

### TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: 20 to 58.4 MHz, Depending on configuration (See Chart).

Planning range: Set 1 approx 16 km (moving)  
Set 2 approx 1.6 km

Power Output: Set 1 16 w (High)  
2 w (Low)

Set 2 approx .5 w

Power requirements: Vehicular: 12 or 24 v dc  
Ground: MX-898 and  
CY-590

Squelch: Carrier (old)

### SPECIAL FEATURES

Remote: Control Group AN/GRA-6 is used in  
vehicular configurations

Retransmission: Control, Radio Set C-435/GRC  
is used to provide retransmission  
capability. A frequency separation  
of 10 MHz must be maintained be-  
tween transmit and receive fre-  
quencies.

## CONFIGURATIONS

NOMENCLATURE	USED BY	MISIC	INFANTRY	ARTILLERY	AUXILIARY RECEIVER		SET 1	SET 2	INTERPHONE AMPLIFIER	RETRANSMISSION UNIT	
					R-108	R-109	R-110	RT-66	RT-67	RT-68	RT-70
AN/GRC-3					1		1	1	1	1	1
AN/GRC-4							1				
AN/VRC-1							2				
AN/VRC-8							1				
AN/VRC-13											
AN/VRC-16											
AN/VRC-20											
AN/GRC-5							1				
AN/GRC-6							1				
AN/VRC-2								2			
AN/VRC-9									1		
AN/VRC-14									1		
AN/VRC-17										1	
AN/VRC-21											1
AN/GRC-7											1
AN/GRC-8											1
AN/VRC-3									2		
AN/VRC-10											
AN/VRC-15											
AN/VRC-16											
AN/VRC-22											
AN/VRC-7											
AN/UIC-1											

# RECEIVER-TRANSMITTER, RT-66/GRC, 67/GRC, AND 68/GRC

STATUS: C&T; RT 66/GRC FSN: 5820-503-1508  
RT 67/GRC FSN: 5820-503-1507  
RT 68/GRC FSN: 5820-503-1505

REF: TM 11-289

## GENERAL INFORMATION

The RT-66/GRC, 67/GRC, and 68/GRC are short-range receiver-transmitters normally used as Set 1 of the AN/GRC-3 through -8 series.

## TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: RT 66/GRC, 20-27.9 MHz

Frequency assignment every 100 kHz  
(80 chans)

RT 67/GRC, 27-38.9 MHz

Frequency assignment every 100 kHz  
(120 chans)

RT 68/GRC, 38-54.9 MHz

Frequency assignment every 100 kHz  
(170 chans)

Planning range: Moving: 16 km

Stationary: 24 km

Power output: High, 16 w

Low, 2 w

Antenna: RT 66-67/GRC, 10 ft vehicular whip,  
ground plane RC-292

RT 68/GRC, 6 ft vehicular whip,  
ground plane RC-292

Power source: Vehicular: PP-109 (12 v dc);  
PP-112 (24 v dc)

Ground: MX-898

## SPECIAL FEATURES

Tuning: Detent or continuous

Calibration (operator): None

Squelch: Carrier (old)

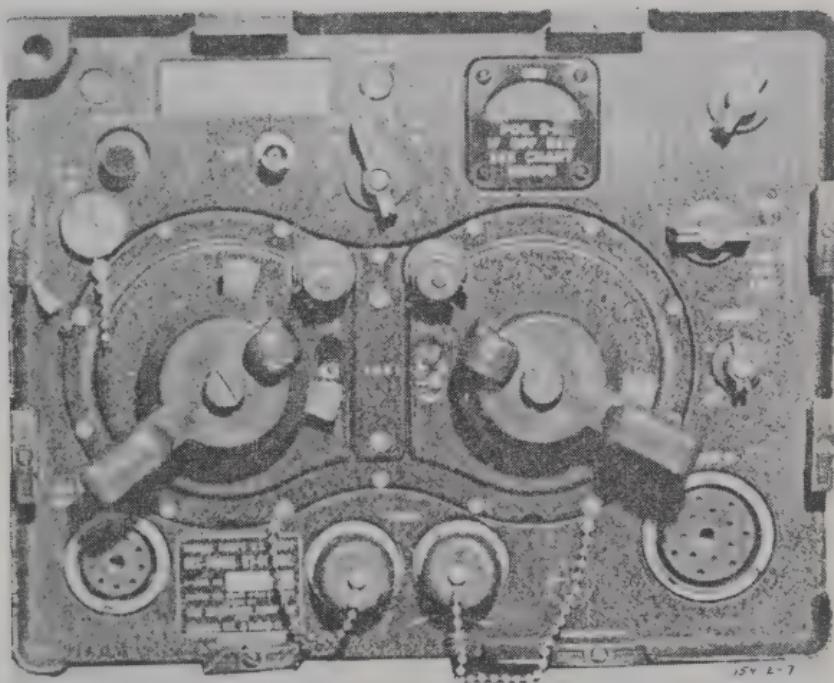
Ring: 1600 Hz

Remote: Using GRA-6

Re transmission: Using C-435

Presets: 2

Weight: 38 lbs.



# RECEIVER-TRANSMITTER RT-70/GRC (WITH AF AMPLIFIER AM-65/GRC)

STATUS: C&T; FSN: 5820-503-1518  
REF: TM 11-290

## GENERAL INFORMATION

The RT-70/GRC is included as a component of the AN/GRC-3 through -8 series and is designated as Set 2.

## TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: 47 to 58.4 MHz

Frequency assignment every 100 kHz  
(115 chans)

Power output: .5 w

Planning range: 1.6 km

Antenna: 4 ft vehicular whip

Power source: Vehicular: AM-65/GRC

Ground: Battery Box CY-590/GRC

## SPECIAL FEATURES

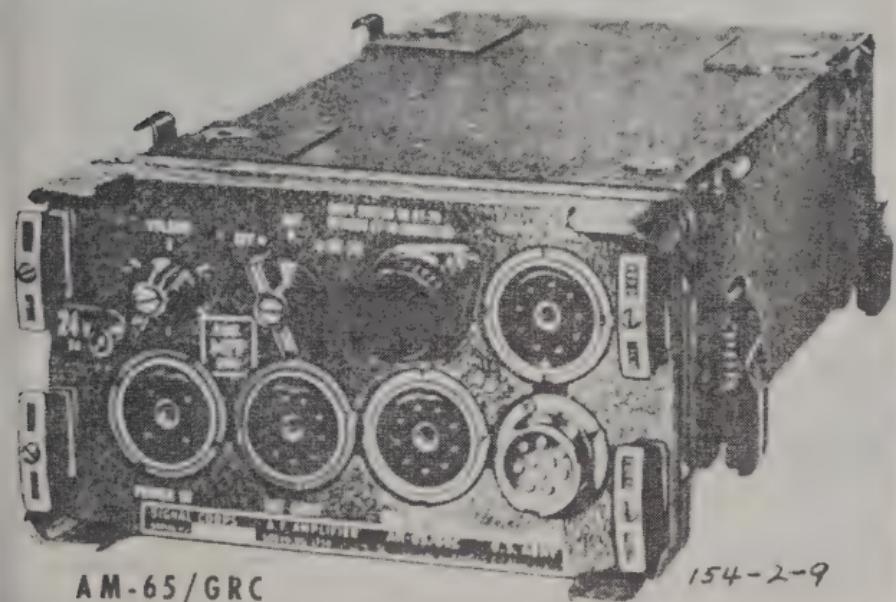
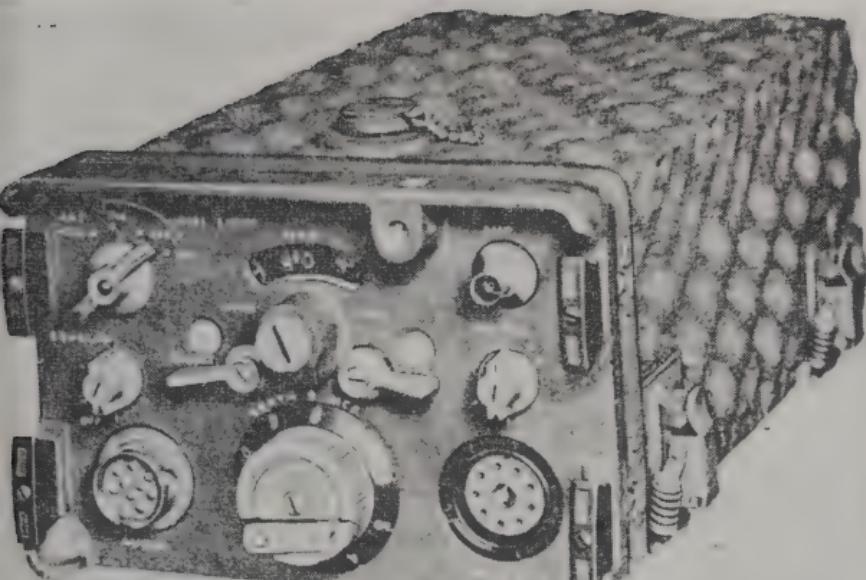
Tuning: Continuous

Calibration: Every 1 MHz

Squelch: Carrier (old)

Presets: 2

Weight: (RT-70 and AM-65) 32.5 lbs.



RECEIVER, RADIO R-108/GRC, R-109/GRC,  
AND R-110/GRC

STATUS: C&T; R-108 FSN: 5820-503-1258  
R-109 FSN: 5820-503-1413  
R-110 FSN: 5820-503-1254

REF: TM 11-898

GENERAL INFORMATION

The R-108/GRC, R-109/GRC, and R-110/GRC are the auxiliary receivers of the AN/GRC-3 through -8 series.

TECHNICAL CHARACTERISTICS

Type of service: 36F3

Frequency range: R-108/GRC, 20 to 28 MHz

Frequency assignment every 100 kHz  
(80 chans)

R-109/GRC, 27 to 39 MHz

Frequency assignment every 100 kHz  
(120 chans)

R-110/GRC, 38 to 55 MHz

Frequency assignment every 100 kHz  
(170 chans)

Planning range: Dependent on transmitter

Antennas: Uses Antenna on Set 1 or additional antenna

Power source: 12 or 24 v dc

SPECIAL FEATURES

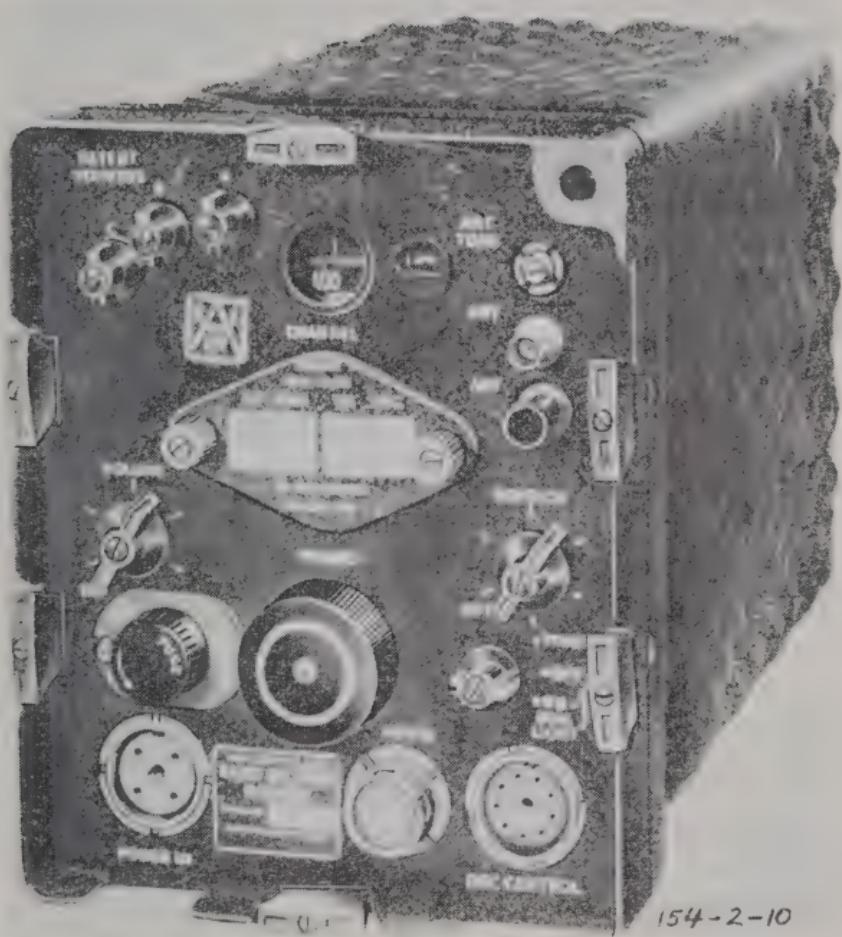
Tuning: Continuous

Calibration: Every 4.3 MHz (at red indexes on dial)

Presets: 3

Squelch: Carrier (old)

Weight: 28 lbs.



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# AN/VRC-12 FAMILY OF RADIO SETS

STATUS: STD-A; FSN: 5820-892-0868  
(AN/VRC-12)

REF: TM 11-5820-401-10

## GENERAL INFORMATION

Radio Sets AN/VRC-12 and AN/VRC-43 through -49 are short-range vehicular and fixed radio sets designed for general tactical use. Combinations of basic components are used to form eight configurations which replace the AN/GRC-3 through -8 series.

## TECHNICAL CHARACTERISTICS

Type of service: 30F3

Frequency range: 30-75.95 MHz

Channel every 50 kHz  
(920 chans)

Planning range: 32 km fixed; 24 km moving

Power output: High, 35 w, Low, 3 w

Antennas: 10 ft vehicular whip, AT-912 or AS-1729 (RT-246 or RT-524)

11 ft vehicular whip (R-442)

Power source: 24 v dc

## SPECIAL FEATURES

Tuning: Detent

Calibration (operator): None

Squelch: Tone (150 Hz called "new") and carrier (old)

Remote: Using GRA-39 or GRA-6 w/CX-7474

Retransmission: Using C-2299 (MK-456/GRC can also be used)

Configurations:

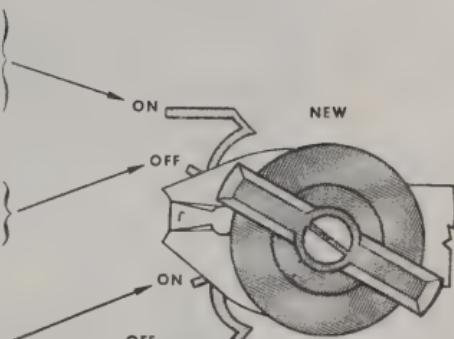
Component (VRC)	12	43	44	45	46	47	48	49
RT-246/VRC	1	1	1	2	0	0	0	0
R-442/VRC	1	0	2	0	0	1	2	0
RT-524/VRC	0	0	0	0	1	1	1	2
MT-1029/VRC	1	1	1	2	1	1	1	2
MT-1898/VRC	1	0	2	0	0	1	2	0
C-2299/VRC	0	0	0	1	0	0	0	1
AT-912/VRC or AS-1729	1	1	1	2	1	1	1	2

An incoming carrier with 150 Hz TONE is required by receiver section to deactivate squelch circuitry. Transmitter 150 Hz oscillator operates when RT unit is keyed.

No squelch operation in receiver section. Transmitter 150 Hz oscillator operates when RT unit is keyed.

An incoming carrier is required by receiver section to deactivate squelch circuitry. Transmitter 150 Hz DOES NOT OPERATE when RT unit is keyed.

No squelch operation in receiver section. Transmitter 150 Hz oscillator operates when RT unit is keyed.



**NOTES:**

1. SETTING THE SLIDE TO RESTRICT SQUELCH SELECTION TO EITHER THE OLD OR THE NEW FUNCTION IS AN ORGANIZATIONAL MAINTENANCE RESPONSIBILITY.
2. IF RADIO SETS THAT USE OLD (CARRIER OR NOISE) SQUELCH ARE OPERATED IN A NET WITH AN/VRC-12 TYPE RADIOS, THE LATTER SHOULD BE RESTRICTED TO OLD SQUELCH OPERATION ONLY.
3. IF ALL RADIO SETS IN A NET ARE CAPABLE OF TRANSMITTING THE 150 Hz TONE REQUIRED BY THE NEW SQUELCH CIRCUITRY, THEY SHOULD BE RESTRICTED TO NEW SQUELCH OPERATION ONLY.
4. NEW OFF AND OLD OFF SWITCH SETTINGS ARE ELECTRICALLY IDENTICAL.

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## Functions of Squelch Control

## RECEIVER-TRANSMITTER RT-246/VRC AND RT-524/VRC

STATUS: STD-A; RT-246 FSN: 5820-892-0623  
RT-524 FSN: 5820-892-0622

REF: TM 11-5820-401-10

### GENERAL INFORMATION

The RT-246 and RT-524 are short-range receiver-transmitters used in the VRC-12 and VRC-43 through -49 configurations.

### TECHNICAL CHARACTERISTICS

Same as for the VRC-12 Family

### SPECIAL FEATURES

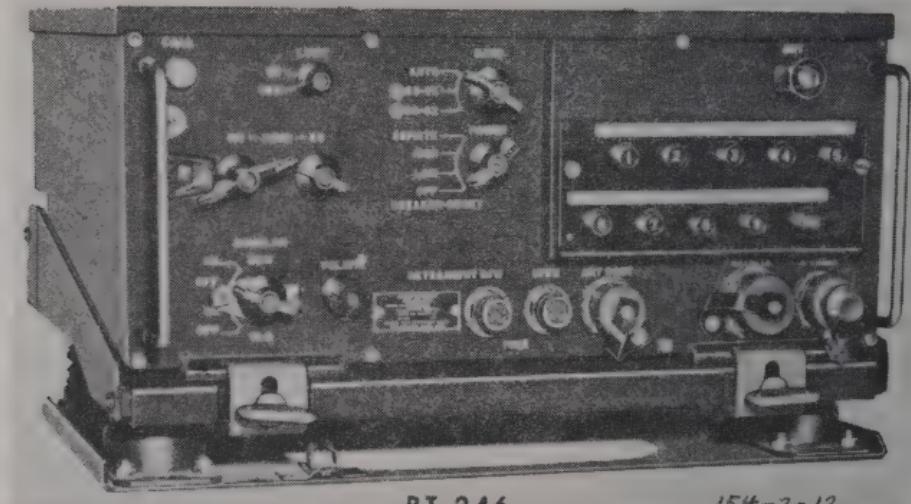
Presets: RT-246: 10

RT-524: None

RT-524 has a speaker for monitoring

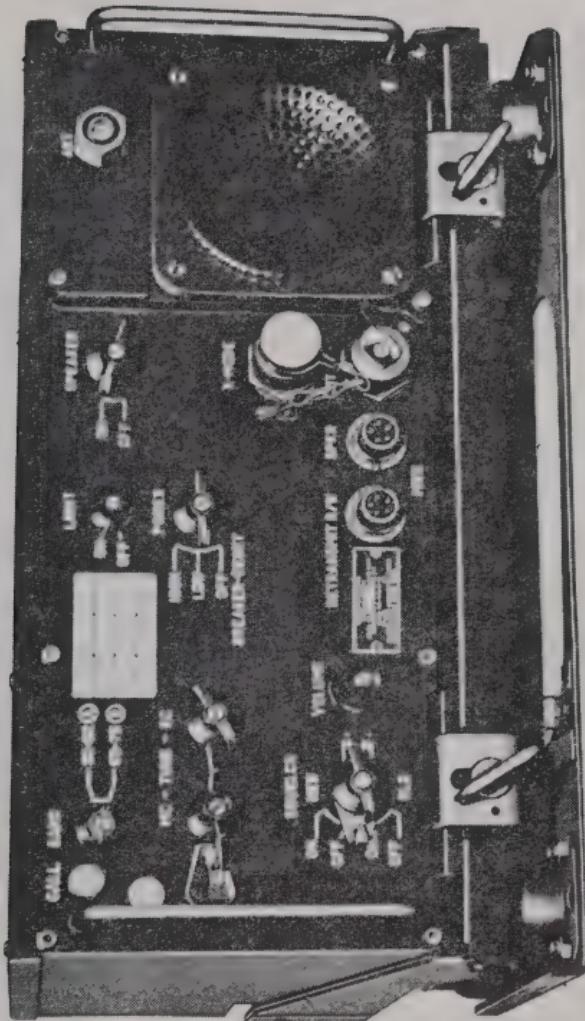
Weight: RT-246: 61 lbs.

RT-524: 58 lbs.



RT-246

154-2-12



154-2-13

RT-524

## RECEIVER, RADIO R-442/VRC

STATUS: STD-A; FSN: 5820-892-0624  
REF: TM 11-5820-401-10

### GENERAL INFORMATION

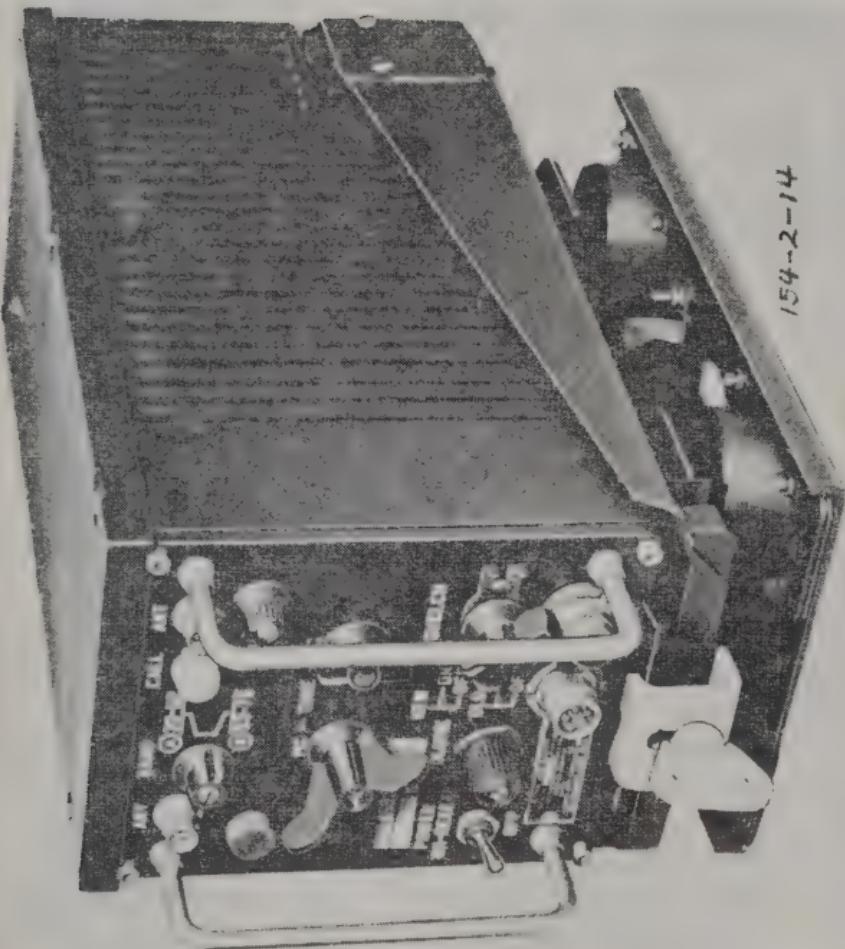
The R-442/VRC is the auxiliary receiver of the Radio Sets AN/VRC-12, AN/VRC-44, AN/VRC-47, and AN/VRC-48.

### TECHNICAL CHARACTERISTICS

Same as VRC-12 Series

### SPECIAL FEATURES

Squelch: Tone (150 Hz called "new") and carrier (old)  
Presets: None  
Weight: 18 lbs.



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## RADIO SET CONTROL AN/GSA-7

STATUS: STD-A; FSN: 5820-543-1397

REF: TM 11-5135-15

### GENERAL INFORMATION

The AN/GSA-7 is a small, lightweight electronic switching device used to integrate radio equipment with local battery, push-to-talk telephone circuits.

### TECHNICAL CHARACTERISTICS

Frequency: Voice (300-3500 Hz)

Range (Km): 16, using WD-1

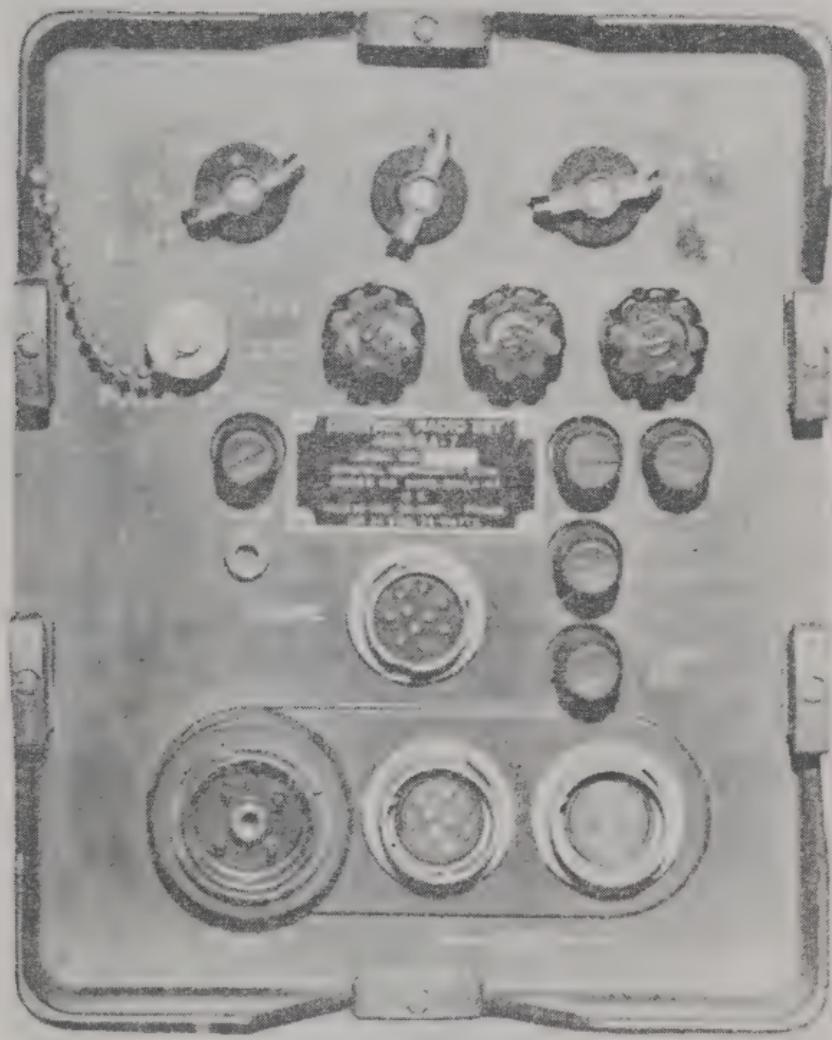
Power source: Uses 22/30 v dc (vehicular)

115 v ac or 230 v ac 50-400 Hz

### SPECIAL FEATURES

1. Converts 20 Hz telephone ringing signal to 1600 Hz tone for radio transmission.
2. Converts 1600 Hz tone to 20 Hz for telephone ringing.
3. Provides 2000 Hz warning beep.
4. Connects telephone to radio receiver.
5. Connects telephone to radio transmitter when press-to-talk switch for telephone is depressed.
6. Allows telephone operator to key radio transmitter when following conditions are met:
  - (1) Telephone is within 16 km of GSA-7 (when using WD-1 field wire)
  - (2) Dc loop is completed.
  - (3) Correct polarity is observed with respect to keying line.
7. Can be used with AN/VRC-12 family using Cable Assembly CX-7474.

Weight: 27.5 lbs.



## CONTROL GROUP AN/GRA-6

STATUS: STD-A; FSN: 5820-644-4554

REF: TM 11-5038

### GENERAL INFORMATION

The AN/GRA-6 is used to remote the operation of radio sets with 10-pin audio connectors.

The AN/GRA-6 consists of Local Control C-434 and Remote Control C-433.

### TECHNICAL CHARACTERISTICS

Frequency range: Voice frequency

Planning range: 3.2 km using WD-1

Power requirements: C-433 BA-30 (2 ea),  
BA-414 (1 ea)  
C-434 BA-30 (2 ea)

### SPECIAL FEATURES

1. Two-way telephone communication between local and remote unit.
2. Two-way 20 Hz ringing between local and remote unit.
3. Control operation of 2 radio sets from either remote or local unit.
4. Control operation plus power on-off of one radio set from remote or local unit.

Weight: C-433, 7 lbs.

C-434, 10.5 lbs.



154-2-16

Remote Unit



Local Unit

## RADIO SET CONTROL GROUP AN/GRA-39

STATUS: STD-A; FSN: 5820-949-9909

REF: TM 11-5820-477-12

### GENERAL INFORMATION

Radio Set Control AN/GRA-39 is used to remote the operation of radio sets with a 5-pin audio connector.

The AN/GRA-39 consists of Local Control Unit C-2329 and Remote Control Unit C-2328.

### TECHNICAL CHARACTERISTICS

Frequency range: Voice frequency

Planning range: 3.2 km using WD-1

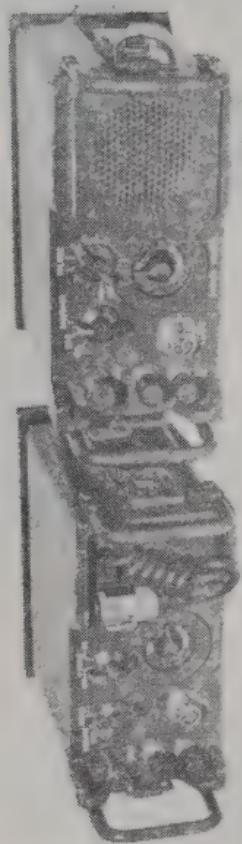
Power requirements: Six batteries, BA-30, in each unit

### SPECIAL FEATURES

1. Two-way telephone communication between local and remote unit.
2. Two-way 20 Hz ringing between local and remote unit.
3. Monitoring and control of operation of radio set from local or remote unit.
4. Remote unit generates 3900 Hz tone to key radio

Weight: C-2328, 11 lbs.

C-2329, 10.25 lbs.



Local Unit      Remote Unit

## ANTENNA GROUP RC-292

STATUS: STD-A; FSN: 5820-497-8554

REF: TM 11-5820-348-15

### GENERAL INFORMATION

The RC-292 is a general purpose stationary ground plane antenna used to extend the range of tactical FM radio sets. The radiating and ground plane elements must be of the proper length for a particular operating frequency.

### TECHNICAL CHARACTERISTICS

Frequency range: 20 to 75.95 MHz

Planning range: Approximately twice the normal range obtained from a quarter-wave whip.

Radio Set or Receiver-Transmitter	Operating frequency (MHz)	Type of sections used						Type of ground plane sections					
		AB-21/GR	AB-22/GR	AB-23/GR	AB-24/GR	AB-21/GR	AB-22/GR	AB-23/GR	AB-24/GR	AB-21/GR	AB-22/GR	AB-23/GR	AB-24/GR
RT-66/GRC AN/PRC-8	20 to 27.9	6	3	1	1	1	18	3	1	1	1	1	1
RT-67/GRC AN/PRC-9	27 to 38.9	4	1	1	1	1	15	2	1	1	1	1	1
RT-68/GRC AN/PRC-10	38 to 54.9	3	0	1	1	1	12	1	1	1	1	1	1
RT-246/VRC RT-524/VRC PRC-25/77	30 to 36.5 36.5 to 50.5 50.5 to 75.95	4	1	1	1	1	15	2	1	1	1	1	1

#### RC-292 ANTENNA SECTION REQUIREMENTS

## ANTENNA, HOMING LOOP AT-784/PRC

STATUS: STD-A; FSN: 5985-086-7651

REF: TM 11-5985-284-15

### GENERAL INFORMATION

The AT-784/PRC is a directional loop antenna with sensing element used with Radio Sets AN/PRC-25/77 and the AN/VRC-12 family.

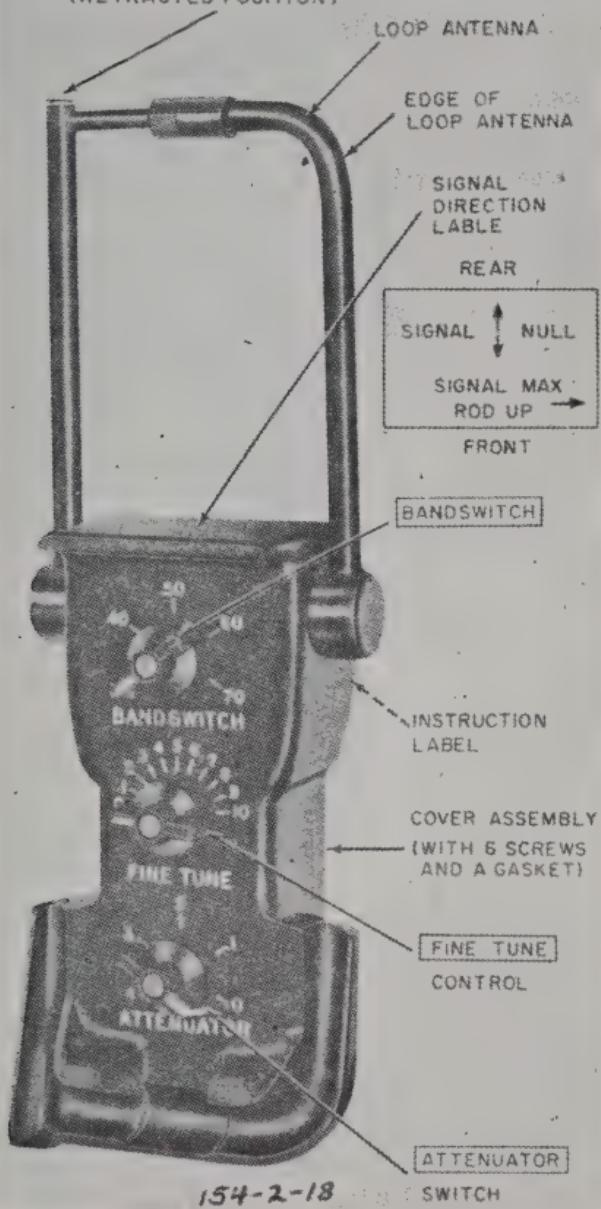
### TECHNICAL CHARACTERISTICS

Frequency range: 30 to 76 MHz

Planning range: Depends upon radio sets used.

Power source: None.

TELESCOPING  
(SENSE) WHIP ANTENNA  
(RETRACTED POSITION)



## ANTENNA, LONG WIRE AT 984A/G

STATUS: STD-A; FSN 5820-926-0201

REF: TM 11-5820-398-12-51

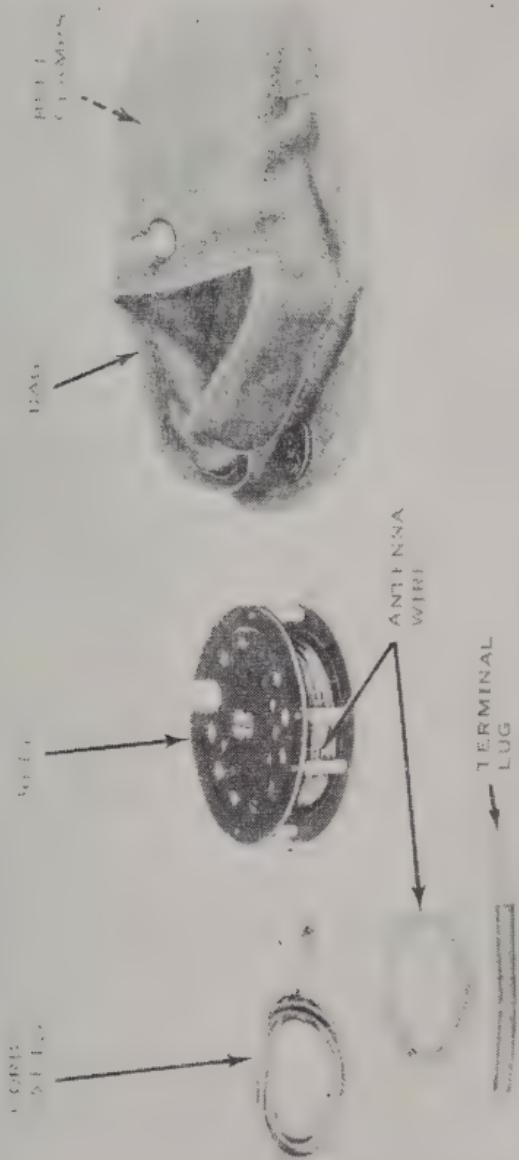
### GENERAL INFORMATION

The AT-984A/G is a long-wire, multiple wavelength antenna that is used to extend the normal transmission and reception range of radio sets that are provided with the RT-505/PRC-25 and RT-841/PRC-77

### TECHNICAL CHARACTERISTICS

Frequency range: 30 to 76 MHz

Planning range: Long wire to 9 ft whip,  
12 miles



T M3820-390-17 54



CHAPTER 2. AMPLITUDE MODULATED  
AND SINGLE SIDEBAND RADIO SETS  
AND ASSOCIATED EQUIPMENT

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## RADIO SET AN/VRC-24

STATUS: AN/VRC-24 STD: B 5820-543-1977  
AN/VRC-24A STD: A 5820-892-3722  
REF: TM 11-5820-222

### GENERAL INFORMATION

The AN/VRC-24 is used for communications with aircraft in close support of ground operations.

### TECHNICAL CHARACTERISTICS

Type of service: 6A3

Frequency range: 225.0 to 499.9 MHz w/chan  
every 100 KHz (1750 chan)

Planning range: Depends on height of aircraft  
(approx 50 km at 1000 ft)

Power output: 1.5 watts

Antennas: Center fed broadband vertical dipole  
AT 803/VRC-24

Power Source: Vehicular, uses 24 V DC, Fixed  
installation requires 115/230 V  
AC 50/60 Hz

### SPECIAL FEATURES

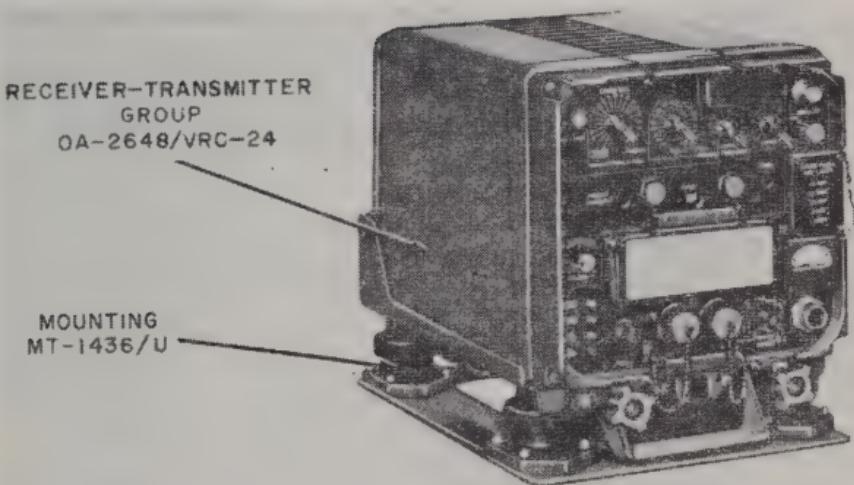
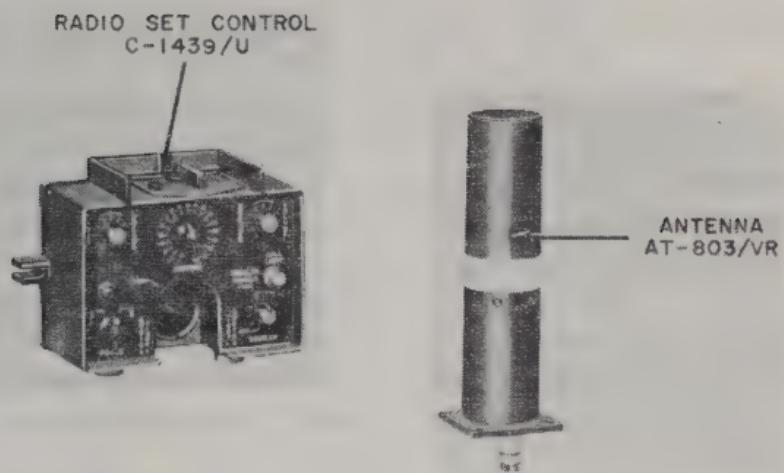
Calibration: None

Presets: 19 channels

Remote: Using AN/GRA-6

Retransmission: May be used as a retransmission device for Radio Sets AN/GRC-3 through 8.

Weight: 62 lbs



## RADIO SETS AN/GRC-87 AND AN/VRC-34

STATUS: AN/GRC-87 STD-A; FSN 5820-543-1997  
AN/VRC-34 STD-A; FSN 5820-543-1996

REF: TM 11-263; TM 11-5820-453-10

### GENERAL INFORMATION

The AN/GRC-87 and the AN/VRC-34 are low power AM voice and CW receiver transmitter sets (RT-77\*/GRC-9) used in forward areas and for patrols. These equipments are being replaced by new portable SSB radio sets.

### TECHNICAL CHARACTERISTICS

Types of service: 6A3, 0.1A1, 2A2.

Frequency range: 2.0 to 12.0 MHz continuously tuned in 3 bands or 2 crystal frequencies per band.

Planning range:

Short distance: Ground-wave propagation to 15 miles. (See ground-wave propagation charts).

Intermediate distance: Sky-wave path.

(See intermediate distance propagation charts).

Power output: Ground operation (with GN-58)

HI: 3.6 w voice

10 w CW

LO: 1.2 w voice

5 w CW

## FIXED AND VEHICULAR OPERATION (WITH

PP-327, DY-88 OR DY-105);

HI: 7 w voice

15 w CW

LO: 1 w voice

5 w CW

Antenna: 15ft whip consisting of mast sections

MS-116A, MS-117A and MS-118A; AT-101/GRC-109

with 107.5ft of wire and eight ceramic insulators;

AT-102/GRC-109 with 137ft of wire and eight

ceramic insulators.

Power source: DY-105/GRC-109-24v. dc

vehicular supply.

DY-88/GRC-88-6, 12 or 24 v.

dc vehicular supply.

GN-58 generator and BA-48/U  
battery combination.

PP-327 115/220 v 50/60 HZ AC  
fixed power supply.

## SPECIAL FEATURES

Calibration point: Every 200 KHZ on receiver.

Presets: None.

Squelch: None.

Remote: None.

Retransmission: No capability.

Weight: (RT-77/GRC-9) 32 lbs.



RT-77(\*)/GRC-9

TRANSMITTER

RECEIVER

154-2-20

## RADIO SET AN/GRC-19

STATUS: STD-B; FSN: 5820-030-0155

REF: TM 11-5820-295-10

### GENERAL INFORMATION

The AN/GRC-19 is a medium power, voice and CW radio set used at division and battalion level. It also serves as the basic radio set for several radio teletypewriter configurations. Radio Set AN/GRC-19 is replaced by Radio Set AN/GRC-106.

### TECHNICAL CHARACTERISTICS

Type of service: 6A3 and 0.1A1.

Frequency range: Transmitter: 1.5 to 20.0 MHz.

Receiver: 0.5 to 32.0 MHz.

Planning range:

Medium distance: Ground wave propagation to 50 miles depending on conditions. (See ground wave propagation charts).

Intermediate distance: Sky-wave propagation. (See intermediate sky-wave propagation charts).

Power output: 100 w (maximum).

Antennas: 15 ft whip, AN/GRA-4 or AN/GRA-50.

Power source: 28.5 v dc (alternator-rectifier system).

### SPECIAL FEATURES

Calibration: Every 100 kHz (on receiver).

Presets: 8 autotune channels on transmitter (7 numbered presets, 1 manual preset).

Squelch: Carrier.

Remote: Using either CX-2585, OA-1754/GRC, or AN/GRA-6.

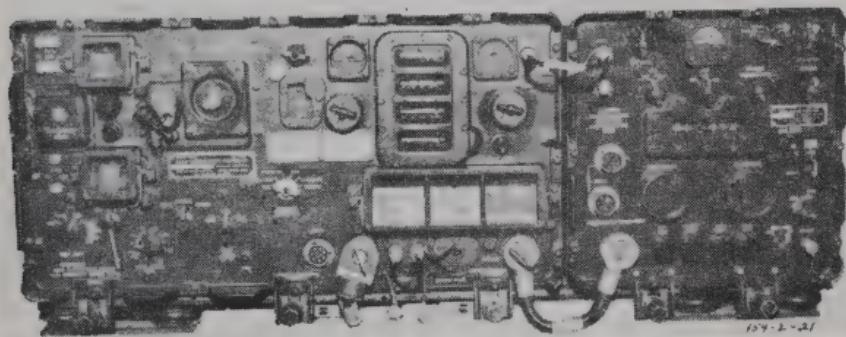
Retransmission: Built-in capability for one-way retransmission.

Tuning: Continuous.

Weight: 221 lbs.

T-195

R-392



AN/GRC-19

# RADIO SET AN/PRC-64

STATUS: STD-B; FSN: 5820-985-9192

REF: DELCO Instruction Manual

## GENERAL INFORMATION

The AN/PRC-64 is a low-power, voice and CW radio set designed to be used by special forces and patrols in forward areas.

## TECHNICAL CHARACTERISTICS

Type of service: 6A3, 0. 1A1.

Frequency range: 2. 2 to 6. 0 MHz, with 4 ea xmit and 4 ea receive crystal controlled channels.

Planning range:

Short distance: Ground wave propagation to 15 miles depending upon conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation path (see intermediate distance sky-wave propagation charts).

Power output: AN/PRC-64 2 w voice. 8 w CW.

AN/PRC-64A1.5 w voice. 5 w CW.

Power source: BA-1509.

Antennas: Doublet and long wire.

## SPECIAL FEATURES

Presets: Total of 4 transmit and 4 receive crystal controlled channels.

Squelch: None.

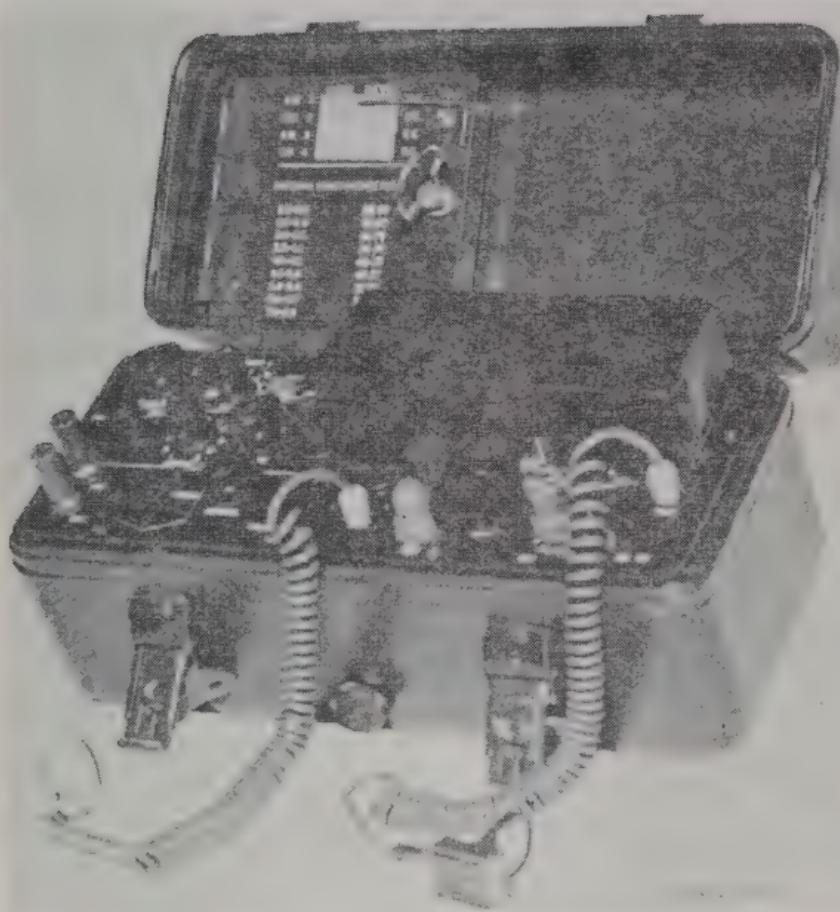
Remote: None.

Retransmission: None.

Voice transmissions: Whisper mike.

CW transmissions: Compatible with AN/GRA-71, Code Burst Transmission Group.

Weight: 7. 5 lbs with battery.



**AN/PRC-64**

## RADIO SET AN/PRC-47

STATUS: STD- B; FSN: 5820-861-3539

REF: TM 11-5820-509-12

### GENERAL INFORMATION

The AN/PRC-47 is a portable SSB transceiver which can be carried by two men. It can be operated as a fixed, mobile, or portable set.

### TECHNICAL CHARACTERISTICS

Type of service: 3A3j (USB), 0.1AI.

Frequency range: 2.0 to 11.999 MHz channel every 1 kHz; digital tuning.

Planning range:

Medium distance: Ground wave propagation to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate distance sky-wave propagation charts).

Power output: High: 100 w (PEP)  
Low: 20 w (PEP)

Antenna: 15 ft whip.

45 ft long wire with insulators at 15 and 25 ft.

Power source: Portable: BB-451(3 ea issued).  
Vehicle: 26.5 v dc.  
Fixed: 115 v ac, 400 Hz.

### SPECIAL FEATURES

Squelch: None.

Remote: AN/GRA-6

Retransmission: None.

Presets: None.

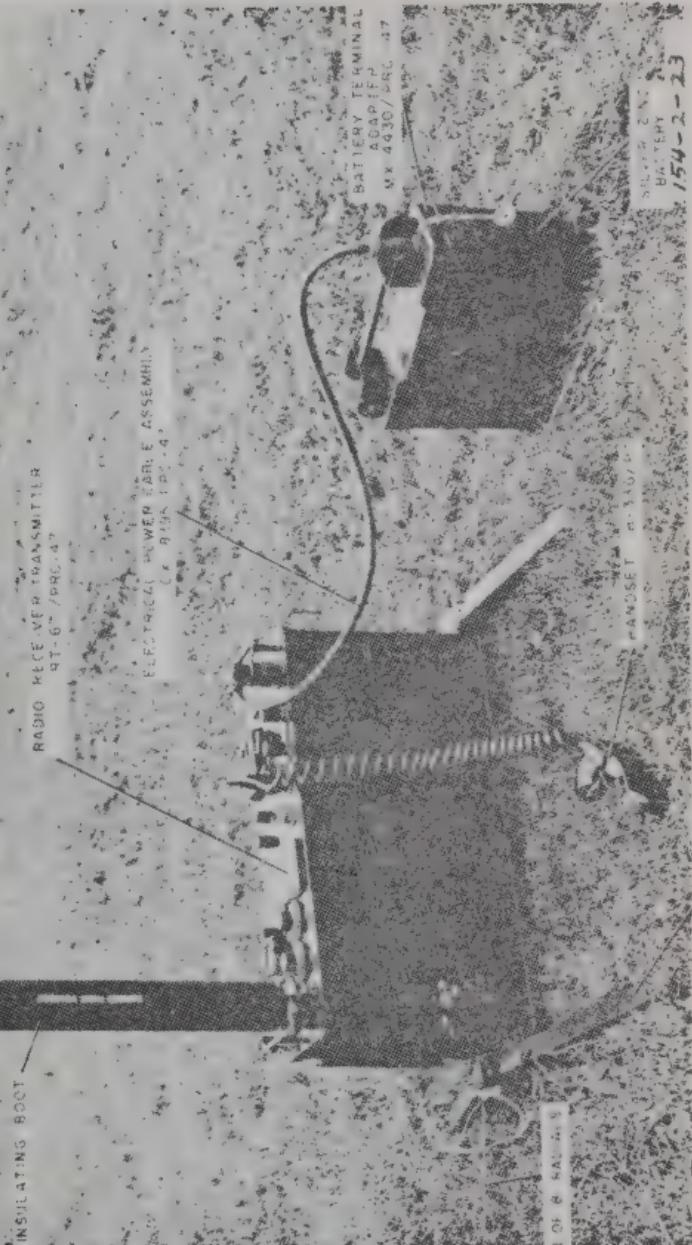
Weight: 190 lbs in pkg case. 80 lbs dpld (approx).

Duty cycle: High power: 1 min transmit.  
9 min receive.

Low power: 2 min transmit.  
9 min receive.

Receiver muting: Receiver remains muted 2 to 4 seconds after mike push-to-talk switch is released.

ANTENNA AS-1320/PRC-47



AN/PRC-47

## RADIO SET AN/PRC-74

STATUS: STD-A; FSN: 5820-935-0030 (AN/PRC-74B)

REF: TM 11-5820-590-12-1 (AN/PRC-74B)  
GENERAL INFORMATION

The AN/PRC-74B is a single sideband (upper sideband only) radio set. May be used with Code-Burst Transmission Group AN/GRA-71. Replaces the AN/TRC-77.

### TECHNICAL CHARACTERISTICS

Type of service: 3A3j; 0. 1A1.

Frequency range: PRC-74: 2-11. 999 MHz.

PRC-74B: 2-17. 999 MHz,  
chan every 1 kHz.

Planning range:

Short range: Ground wave up to 15 miles (see  
ground wave propagation prediction charts).

Intermediate: Sky-wave propagation (see  
intermediate sky-wave propagation charts).

Power output: 15 w PEP.

Antennas: 9 ft 3 in center loaded whip.  
Doublet, and 100 ft long wire.

Power source: Portable: wet cell, rechargeable  
nickel-cadmium battery, 2 ea BA-386, 70 ea  
BA-30.

Fixed: PP-4514/PRC-74 w/cables for opera-  
tion on: 110 v ac, 220 v ac (47 to 400 Hz),  
21 to 31 v dc.

### SPECIAL FEATURES

Calibration: Every 1 kHz by operator.

Presets: None.

Squelch: None.

Remote: AN/GRA-39.

Weight: 29. 5 lbs w/nicad battery installed.

AN/PRC-74C is same as AN/PRC-74B except some  
components have been ruggedized and front panel  
assembly is marked in Hertz (Hz) instead of Cycles  
(C).

**AN/PRC-74**

154-2-24



## RADIO SET AN/GRC-106

STATUS: AN/GRC-106 STD B; FSN 5820-167-8003  
AN/GRC-106A STD A; FSN 5320-167-8005

REF: TM 11-5820-520-12

### GENERAL INFORMATION

The AN/GRC-106 is a medium-power, single sideband (USB), vehicular radio set used within the field army. The AN/GRC-106 replaces the AN/GRC-19.

### TECHNICAL CHARACTERISTICS

Types of service: 3A3j, 3A3a, 0.1A1.

Frequency range: 2.000 to 29.999 MHz, channel every 1 KHz, digital tuning, receiver has  $\pm$  600 Hz vernier. The AN/GRC-106A uses RT 834/GRC which has 100 Hz digital tuning for 280,000 channels.

Planning range: Ground wave propagation up to 50 miles (see ground wave propagation prediction charts).

Intermediate distance: Sky-wave propagation (see intermediate sky-wave propagation charts).

Power output: 3A3j - 400 w PEP.

3A3a - 400 w PEP and 70 w carrier.

0.1A1 - 200 w.

Antennas: 15 ft vehicular whip, doublet (AN/GRA-50).

Power source: 28.5 v dc alternator-rectifier system.

### SPECIAL FEATURES

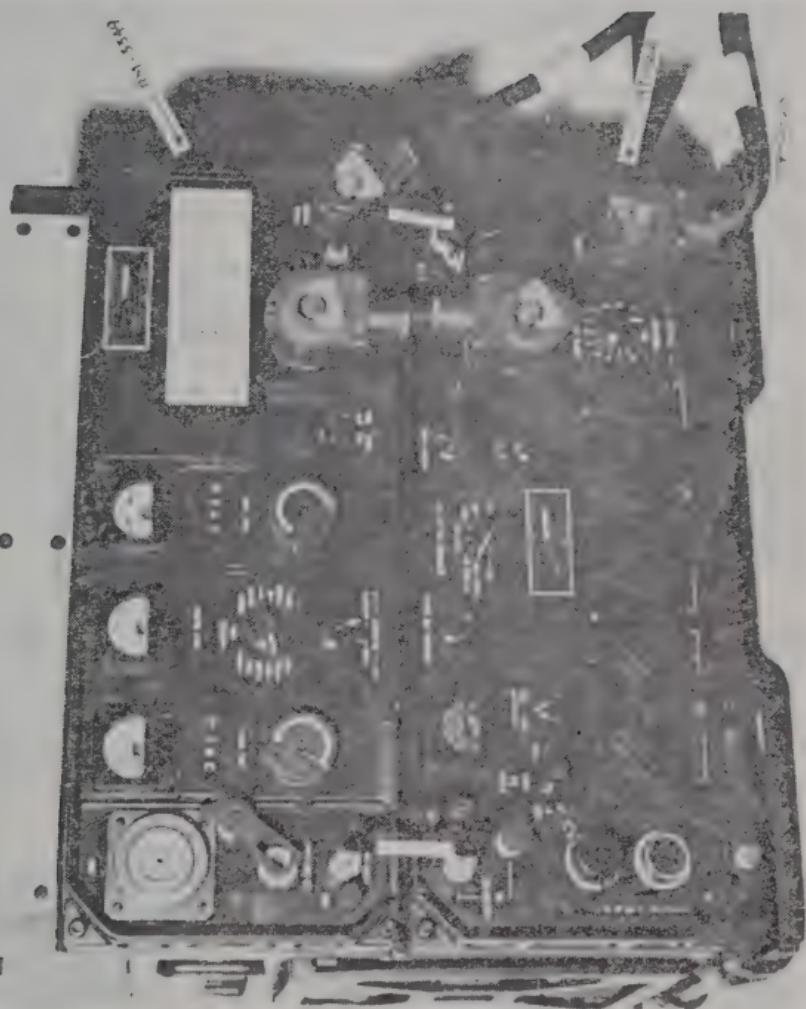
Calibration: None (frequency synthesizer generates frequency).

Presets: None.

Remote: AN/GRA-6 with junction box J-654 installed between AN/GRC-106 and local control C-434.

Retransmission: None

Weight: 128 lbs (installed).



**AN/GRC-106**

# RADIO SET AN/FRC-93

STATUS: STD-A; FSN: 5820-082-4276

REF: TM 11-5820-529-15

TM 11-5820-530-15

TM 11-5820-532-15

TM 11-5820-554-15

## GENERAL INFORMATION

The AN/FRC-93 is a Collins Radio Company commercial product that has been adopted by the military services. The AN/FRC-93 Radio Set provides single-sideband voice (upper or lower sideband) or cw transmission and reception. The set consists of seven major components, including two separate power supplies and a Linear power amplifier.

Receiver-Transmitter RT-718/FRC-93

(Collins KWM-2A) amplifier, RF AM-3979/FRC-93  
(Collins 30L-1) control, Radio Set C-6118/FRC-93  
(Collins 312-B4/B5), Power Supply PP-3990/FRC-93  
(Collins PM-2), Power Supply PP-4151/FRC-93  
(Collins 516-F2), Quartz Crystal Unit Set CK-31/FRC-93  
(Collins CP-1), Microphone Dynamic M-127/FRC-93 (Collins MM-1).

## TECHNICAL CHARACTERISTICS

Types of service: 3A3j (selectable LSB or USB), and 0.1A1.

Frequency range: 3.4 to 5.0 MHz and 6.5 to 30.0 MHz; continuous tuning in 200 KHz bands with crystal unit set, CK-31/FRC-93.

Planning range:

Short distances: Ground wave propagation up to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distances: Sky-wave propagation (see intermediate distance sky-wave propagation charts).

## RADIO SET AN/FRC-93 (con't)

Power output: RT-718 alone 100 w PEP  
WITH AM-3979 600 w PEP

Antennas: doublet, or quarter wave-length whip.  
No matching unit available, requires a normal  
52 ohm unbalanced load.

Power sources:

PP-4151 115 v 50-400 Hz, 4 amp.

PP-3990 110 or 220 v, 50-400 Hz, 4 or 2 amp.  
SPECIAL FEATURES

Calibration: Every 100 kHz.

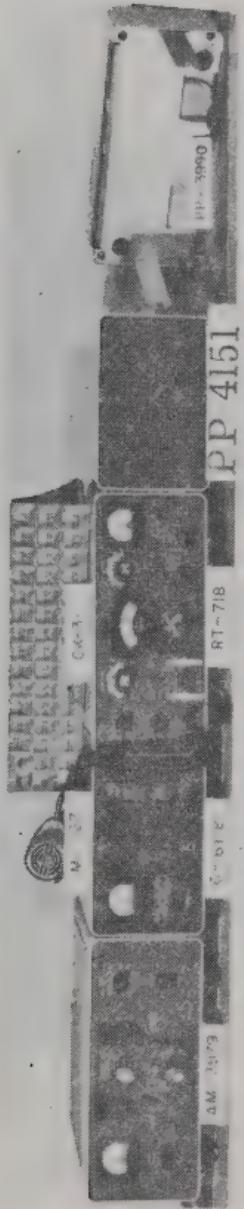
Presets: None.

Remote: None.

Phone patching: with C-6118/FRC-93 (manually or  
VOX).

Wattmeter: Built into C-6118/FRC-93.





AN/FRC-93

# RADIO SET AN/GRC-109

STATUS: STD-A; FSN: 5820-892-0881

REF: TM 11-5820-474-14

## GENERAL INFORMATION

The AN/GRC-109 Radio set is a compact, portable radio station used for cw communications. AM, SSB, CW and MCW signals can be received.

Transmission is made by hand key or an external keyer such as the AN/GRA-71, Code-Burst Transmission Group. EQUIPMENT used by special forces and patrol size units.

## TECHNICAL CHARACTERISTICS

Type of service: Transmit - 0.1A1. Receive - 6A3, 3A3j, 2A2, 0.1A1.

Frequency range: Transmit - 3.0 to 22.0 MHz crystal controlled. Receive - 3.0 to 24.0 MHz tuned continuously or crystal.

Planning range: Short distance: Ground wave propagation (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate sky-wave propagation prediction charts).

Power output: 10 to 15 w, depending on frequency.

Antenna: Simple inverted L constructed of 100 ft of bare copper wire and two porcelain insulators.

Power Source: PP-2685/GRC-109 on 75 to 260 volts AC, 40 to 400 Hz. PP-2684/GRC-109 on 40 to 260 volts AC, 40 to 400 Hz or 6 v dc, or Hand crank generator G-43/G, with CN-690.

## SPECIAL FEATURES

Calibration: Transmitter crystal.

Calibration: None.

Remote: None.

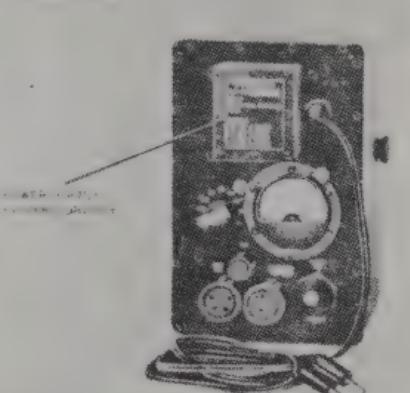
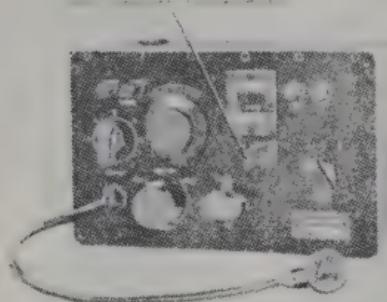
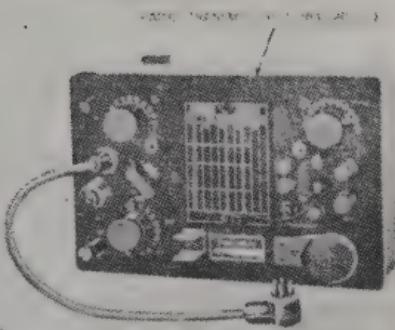
Transmission: None

Weight: Transmitter, T-784 9 lb.

Receiver, R-1004 10 lb.

Power Supply, PP-2684 24.5 lb.

Power Supply, PP-2685 12 lb.



AN/GRC-109

## RADIO SET AN/GRC-41

STATUS: STD-A; FSN: 5820-543-0078

REF: TM 11-621

### GENERAL INFORMATION

The radio set AN/GRC-41 is a radio transmitting and receiving station which provides communications facilities for CW and AM voice operations. The set may be operated while in motion or while in fixed locations.

### TECHNICAL CHARACTERISTICS

Type of service: 6A3 and 0.1A1.

Frequency range: Transmit: 1.5 to 20 MHz.

Receive: 0.5 to 32 MHz.

Planning range: Medium distance: Ground wave propagation up to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate distance propagation charts).

Power output: Voice - 400 w. CW - 450 w.

Antenna: Transmit: 15 ft whip; Long wire; Doublet with AB-155B/U.

Receive: 2 ea 12 ft whips. (1 ea per R-390) or transmitter antenna.

Power source: Fixed 115 volts ac, 50 to 60 Hz.

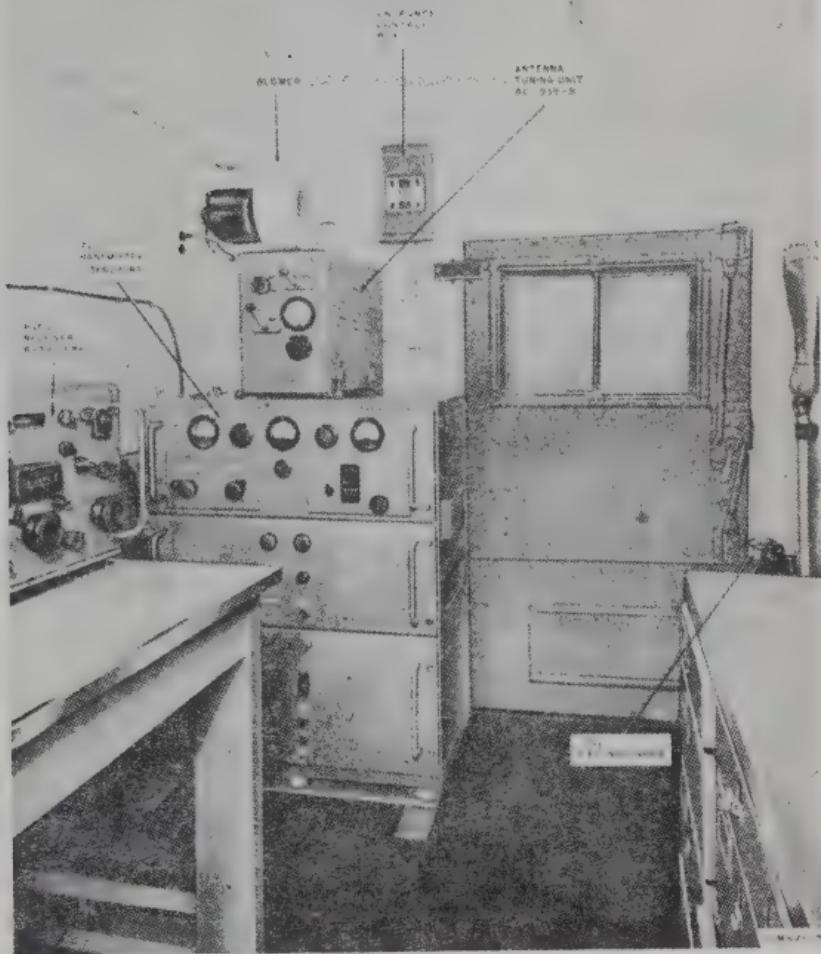
Generator PU-248/U (or equivalent).

### SPECIAL FEATURES

Calibration: Every 100 KHz.

Remote: Junction box JB-60-A remotes Telephone Set TA-43/PT and key J-45.

Frequency separation: 400 kHz.



AN/GRC-41

# CODE-BURST TRANSMISSION GROUP AN/GRA-71

STATUS: STD-A; FSN: 5820-056-6856

REF: TM 11-5835-224-12

## GENERAL INFORMATION

The code-burst transmission group AN/GRA-71 is composed of an electromechanical morse-code generator (MX 4496 semi-automatic and MX 4495 Manual coder) that enables an operator to record messages (in morse code characters) on magnetic recording tape (MA-9); a keyer device (KY 468 keyer) to convert the tape recorded morse encoded characters into equivalent electrical impulses for "keying" an associated transmitter; and a keyer adapter device (MX 4498 keyer adapter) that contains the electronic circuitry for supplying power to the keyer unit and adopting its output to the transmitter. The AN/GRA-71 is employed with radio sets AN/GRC-109, AN/PRC-64 and AN/PRC-74B for transmitting cw signals at 300 wpm.

## TECHNICAL CHARACTERISTICS

Type of service: None (keys transmitter for 0.1A1, cw operation).

Frequency range: None (depends on radio set).

Planning range: None (depends on radio set).

Power output: Electrical signals for keying transmitter for 300 wpm cw.

Antenna: None.

Power source: Spring motor drive keyer, KY-468.

6.3 v dc required from associated transmitter for keyer adapter, MX-4498.

## SPECIAL FEATURES

Calibration: None.

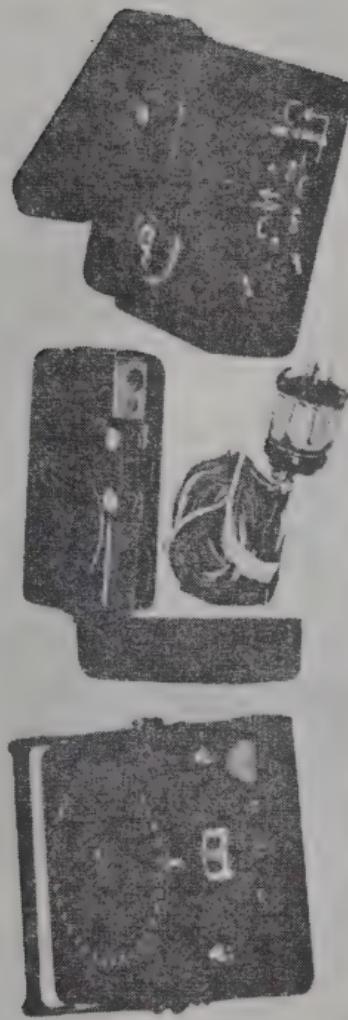
Remote: None.

Weight: 9 1/2 lbs (APPROX).

Maintenance: Follow strict preventative maintenance procedures.

CODER-BURST TRANSMISSION GROUP AN/GRA-71

MAGAZINE, RECORDING TAPE MA-9( )/GRA-71  
(FORMERLY CA-3)



CODER, TAPE MX-4496( )/GRA-71  
(FORMERLY CO-8)  
KEYER CONNECTOR CABLE  
KEYER, KY-68( )/GRA-71  
(FORMERLY KE-8)

CODER, TAPE MX-4495( )/GRA-71  
(FORMERLY CO-3)  
(Not Shown)

Y-63-770

AN/GRA-71

## RADIO SET AN/PRC-41

STATUS: AN/PRC-41 STD-A; FSN: 5820-889-3997  
AN/PRC-41A STD-A; FSN: 5820-104-0351

REF: TM 11-5820-510-12

### GENERAL INFORMATION

The AN/PRC-41 is a low-power AM DSB transceiver which operates in the UHF band. It can be operated as a fixed mobile or portable set. Can provide secure voice (X mode) transmission.

### TECHNICAL CHARACTERISTICS

Type of service: 6A3 or 6A9

Frequency range: 225.0 to 399.9 MHz

Planning range: Line-of-sight. Designed for air-to-ground operations.

Power output: 3 watts

Antennas: Omnidirectional whip, AS 1404/PRC-41  
Unidirectional planar log periodic,  
AS 1405/PRC-41

Power source portable: Wet cell, rechargeable,  
silver-zinc alkaline  
storage battery BB 451/U  
Fixed: PP 3700/PRC-41  
for operation on 115 VAC,  
230 VAC (50-400 Hz)power.

### SPECIAL FEATURES

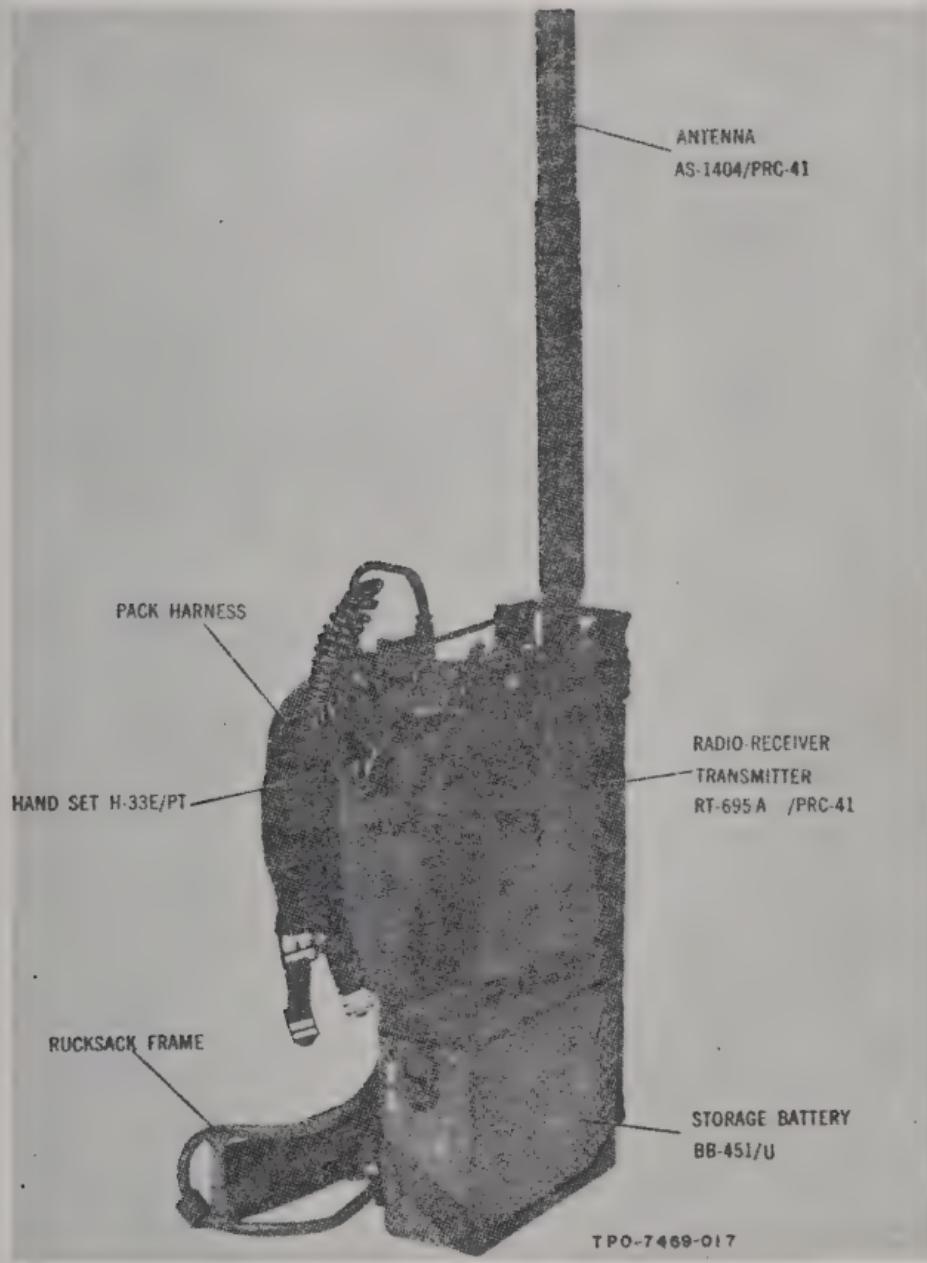
Calibration: None

Presets: None

Squelch: Carrier

Retransmission: Using CX 8688/PRC-41 Cable

Weight: 44.6 lbs RT unit w/BB451 and accessories



Radio Set AN/PRC-41A, Man-Pack Operation Configuration



## CHAPTER 3. RADIO TELETYPEWRITER SETS AND ASSOCIATED EQUIPMENT

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RADIO TELETYPEWRITER SETS  
AN/GRC-46, AN/VSC-1, AND  
AN/VRC-29

STATUS: STD-B; FSN: 5815-543-1760

REF: TM 11-5815-204-10

GENERAL INFORMATION

The AN/GRC-46 is a medium-power radio set normally used in radio teletypewriter sets AN/GRC-46, AN/VSC-1, and AN/VRC-29. It is replaced by the AN/GRC-142.

TECHNICAL CHARACTERISTICS

Type of service: 6A3; 0.1A1, 1.1F1; voice/FSK,  
one-way reversible

Frequency range: Transmit -- 1.5 to 20.0 MHz  
(continuous tuning)  
Receive -- 0.5 to 32.0 MHz  
(continuous tuning)

Planning range:

Medium distance: Ground wave propagation up to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate distance propagation charts).

Power output: 100 w (maximum).

Antennas: 15 ft vehicular whip; doublet.

Power source: Alternator-rectifier system  
(28.5 v dc) or Generator 28.5 v dc

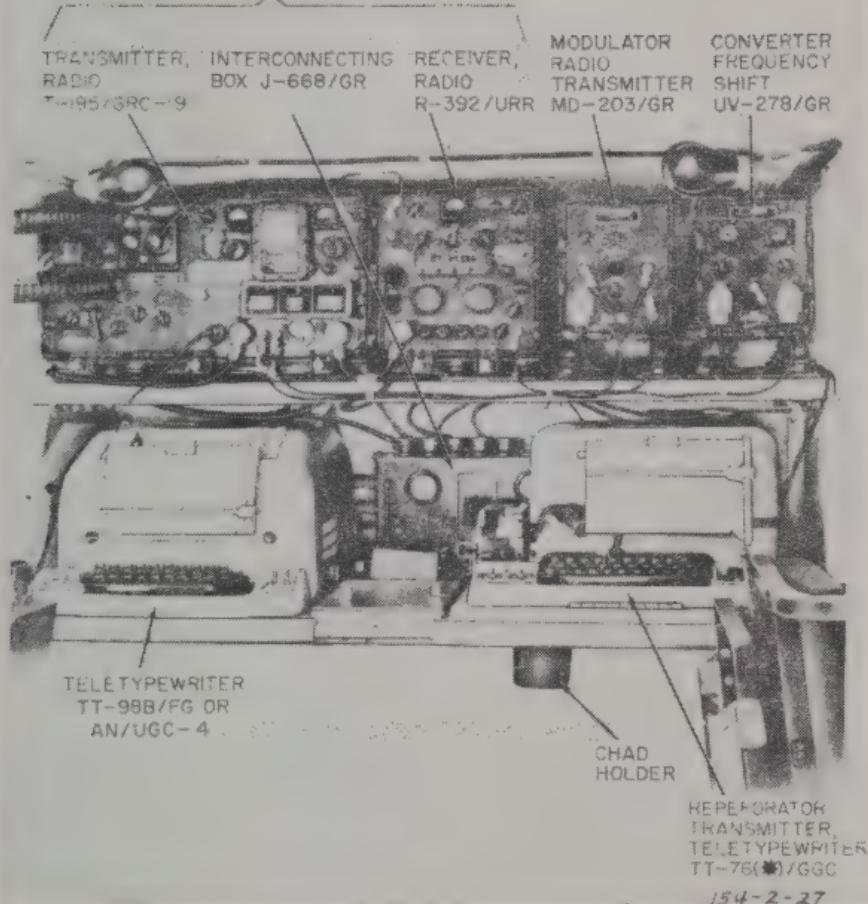
SPECIAL FEATURES

Calibration: Every 100 kHz on calibration line.

Remote: Teletypewriter 1.6 km using either  
Cable Assembly CX-2585 or Control  
Group OA-1754 and voice 3.2 km using  
AN/GRA-6.

Presets: 8 autotune channels on transmitter  
(7 numbered presets, 1 manual preset).

RADIO SET  
AN/GRC-9



**AN/GRC-46**



CONFIGURATIONS

Nomenclature	GRC-19	MD-203	CV-278	TT-76	TT-98	TT-4	Vehicle
GRC-46	1	1	1	1	1	-	3/4 ton
VRC-29	1	1	1	1	1	-	APC
VSC-1	1	1	1	-	-	1	1/4 ton

## RADIO SET AN/GRC-26D

STATUS: STD-A; FSN: 5815-518-0398

REF: TM 11-5820-256-10

### GENERAL INFORMATION

The AN/GRC-26D is a high-power duplex radio teletypewriter set. It has replaced the AN/GRC-26 A, B, and C models and is used at all major levels of command.

### TECHNICAL CHARACTERISTICS

Type of service: 6A3; 0.1A1; 1.1F1; voice/FSK; duplex operation.

Frequency range: GRC-26D --

Transmit: 1.5 to 20 MHz.

Receive: 0.5 to 32 MHz.

GRC-26A, B, C --

Transmit: 2 to 18 MHz.

Receive: 0.5 to 30.5 MHz.

Planning range:

Medium distance: Ground wave propagation up to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate distance propagation charts).

Power output: Voice - 400 w.

CW; RATT - 450 w.

Antenna: 15 ft whip, doublet; long wire

Power source: Fixed -115 v ac, 60 Hz;

Generator PU-474, PU-619.

### SPECIAL FEATURES

Calibration: Every 100 kHz.

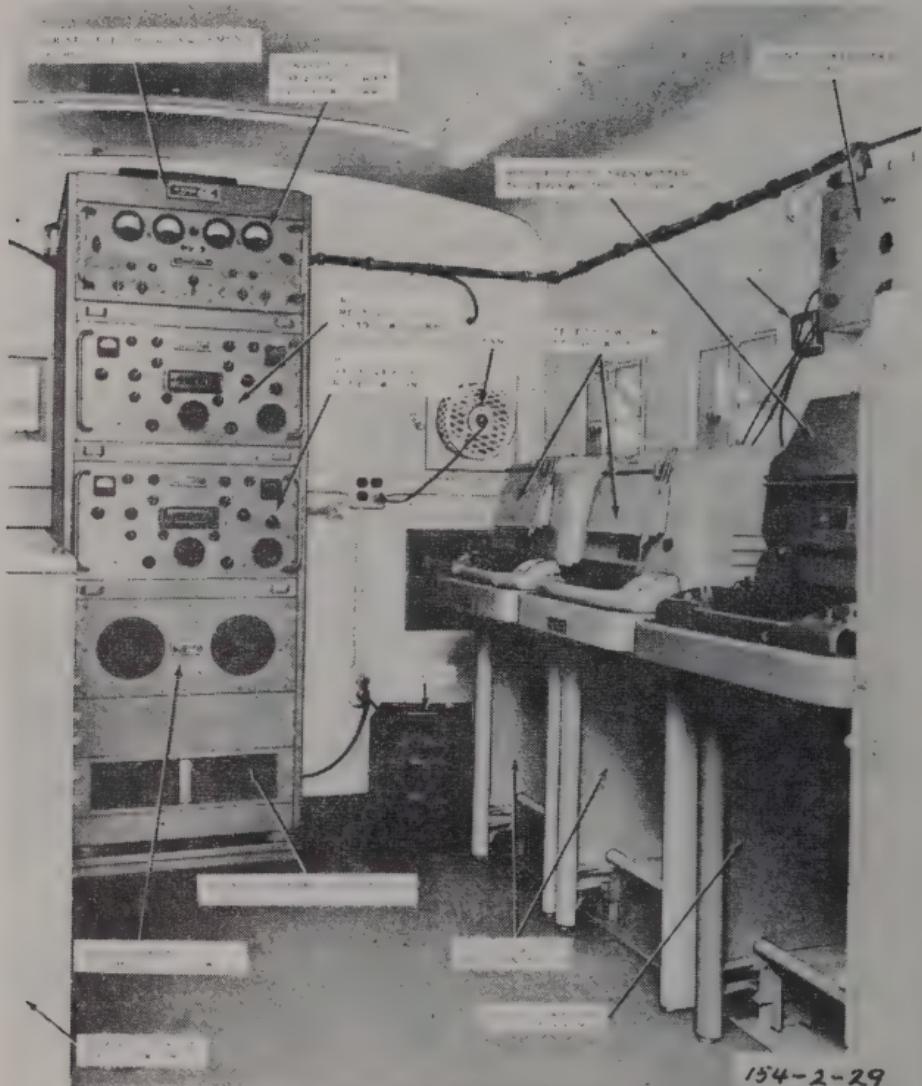
Diversity operation: Capability for space diversity reception with 2 receive antennas spaced 600-900 ft apart

Remote: Teletype writer 16 km using C-1474/GRC and voice 3.2 km with AN/GRA-6.

Frequency separation: 400 kHz.

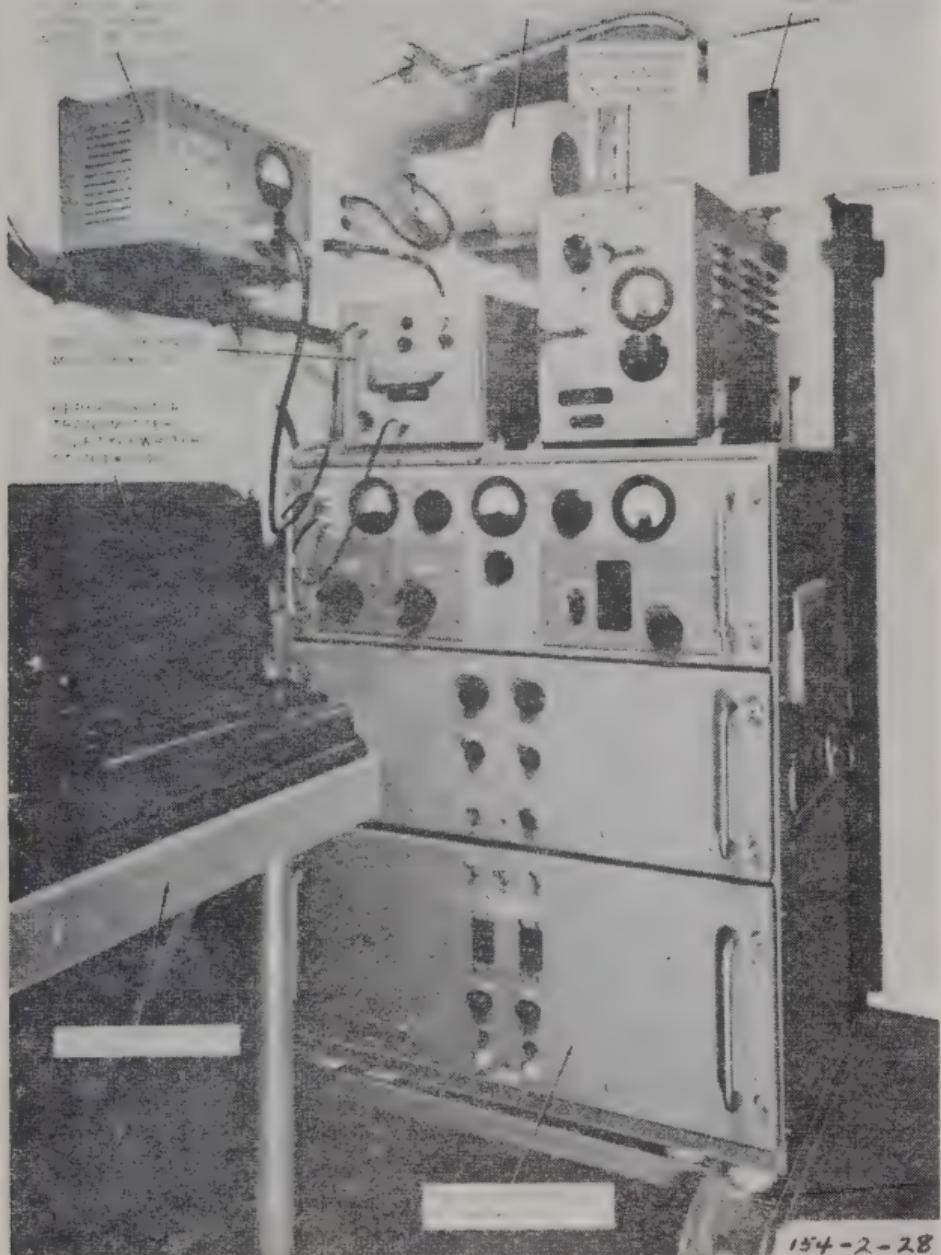
CONFIGURATIONS

Nomenclature	GRC-26D	MRR-8	MRT-9
T-368	1	-	3
R-390	2	8	1
MD-239	1	-	3
CV-116	1	4	-
TN-339	1	-	3
TT-98	2	2	1
TT-76	1	-	1
VEH:	2-1/2-ton	2-1/2-ton	2-1/2-ton
WT	5,660 lbs	4,660 lbs	

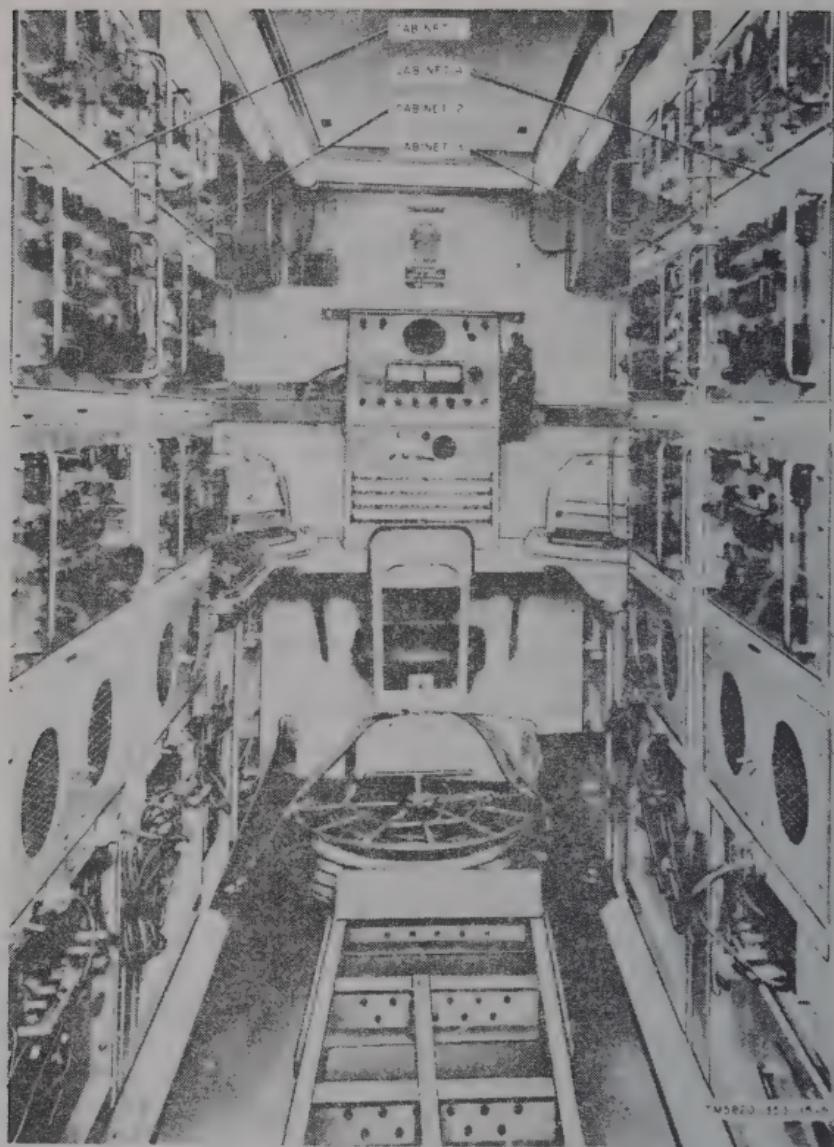


154-2-29

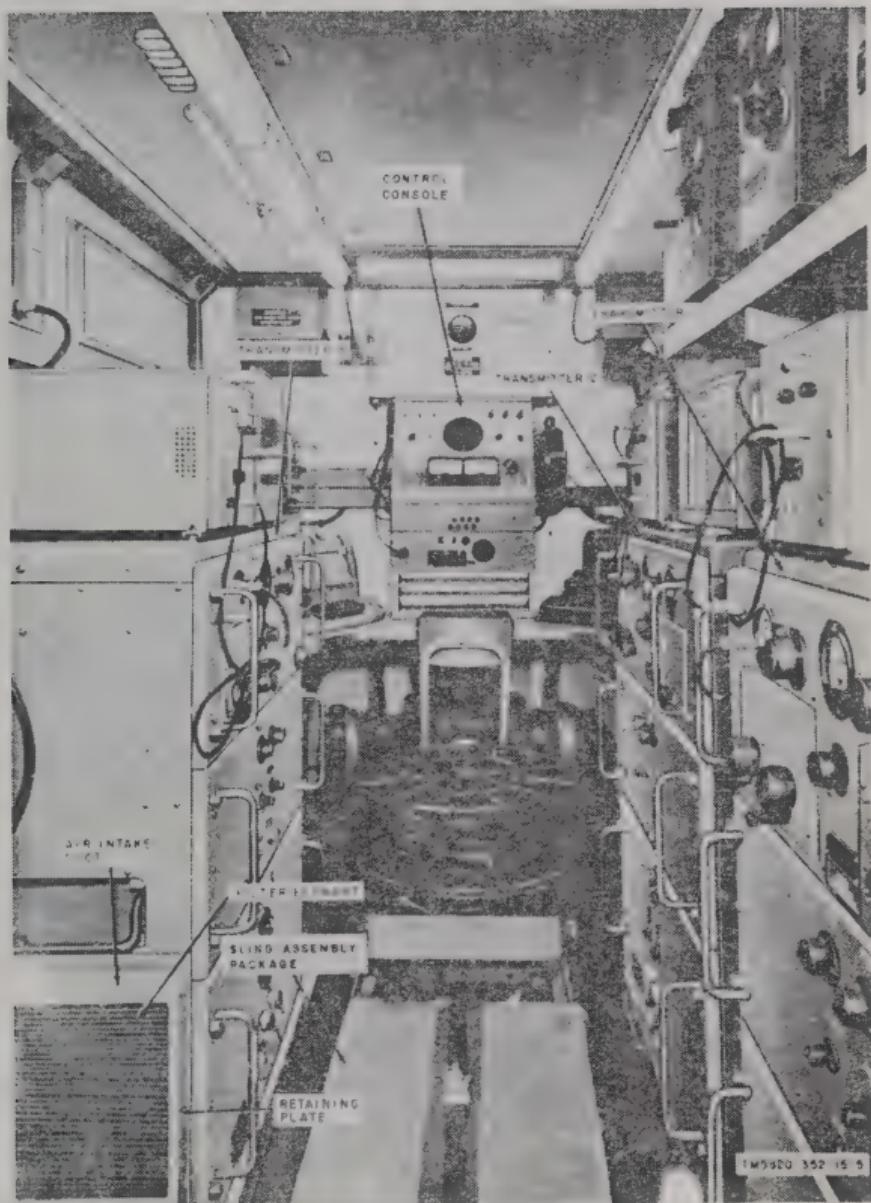
**AN/GRC-26D**



**AN/GRC-26D**



AN/MRR-1



AN/MRT-9

## RADIO SETS AN/GRC-122, AN/GRC-142 AN/VSC-2, AND AN/VSC-3

STATUS: STD-A; AN/GRC-122 FSN: 5815-167-7988  
STD-A; AN/GRC-142 FSN: 5815-168-1556  
STD-A; AN/VSC-2 FSN: 5815-069-8914

REF: TM 11-5815-334-12; AN/GRC-122/142  
TM 11-5815-331-14; AN/VSC-2  
GENERAL INFORMATION

The AN/GRC-122 family of radio sets are medium-power vehicular radio sets used primarily for radio teletypewriter operation. They will replace the older family of radio teletypewriter sets as follows:

AN/GRC-122 replaces AN/GRC-26D  
AN/GRC-142 replaces AN/GRC-46  
AN/VSC-2 replaces AN/VSC-1  
AN/VSC-3 replaces AN/VRC-29

### TECHNICAL CHARACTERISTICS

Type of service: 3A3j; 3A3a; 0.1A1; 3A9j: NSK;  
1.1F1, FSK compatible with older series AM sets.

Frequency range: 2 to 29.999 MHz, digital tuning;  
chan every 1 kHz; receiver has  $\pm$  500 Hz vernier.

Planning range:

Medium distance: Ground wave propagation up to 50 miles depending on conditions (see ground wave propagation charts).

Intermediate distance: Sky-wave propagation (see intermediate distance propagation charts).

Power output: 400 w PEP -- 3A3j;  
400 w PEP -- 3A9j;  
400 w PEP -- w/70 w carrier 3A3a;  
200 w -- 1.1F1;  
200 w -- 0.1A1.

Antenna: 15 ft whip; doublet.

Power source: Vehicular (alternator-rectifier);  
28.5 v dc

Ac generator (using PP-4763) and MK-1162/GRC.

## SPECIAL FEATURES

Diversity operation: Frequency Diversity NSK.

Duplex operation: AN/GRC-122.

One-way reversible operation: AN/GRC-142,  
AN/VSC-2, AN/VSC-3.

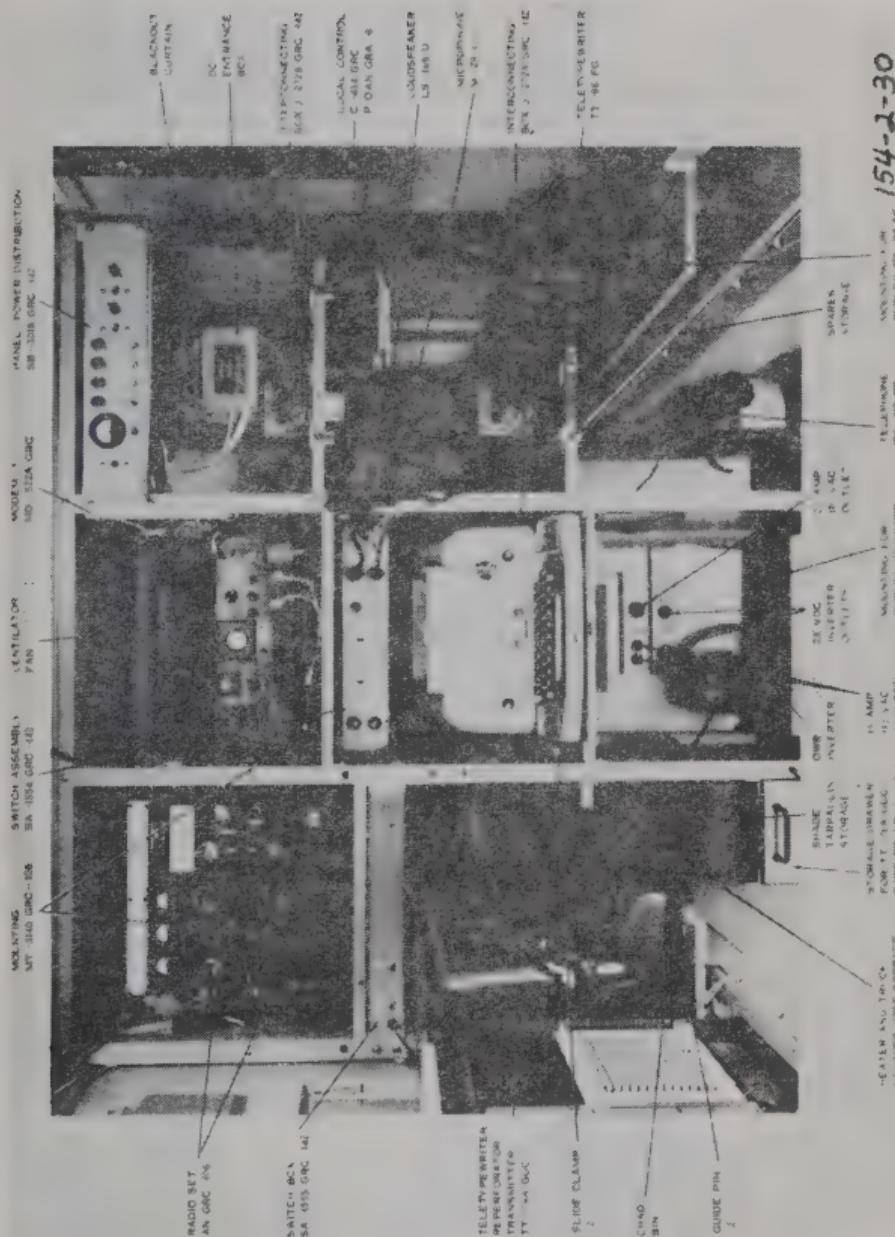
Remote: Up to 3.2 km using AN/GRA-6.

Frequency separation: 1 MHz, or 10% of the higher operating frequency, whichever is greater.

CONFIGURATIONS

Nomenclature	RT-662	AM-3349	MD-522	TT-98	TT-76	TT-4	Vehicle	Wt
AN/GRC-122	2*	1	1	2	1	-	3/4 ton 1-1/4 ton	1832 lbs
AN/GRC-142	1	1	1	1	1	-	3/4 ton 1-1/4 ton	1694 lbs
AN/VSC-2	1	1	1	-	-	1	1/4 ton	
AN/VSC-3	1	1	1	1	1	-	APC	

\*One RT-662 is used as a receiver.



**AN/GRC-142**

AMPLIFIER, RADIO FREQUENCY  
AM 338 GRC 106  
P O AN GRC 106

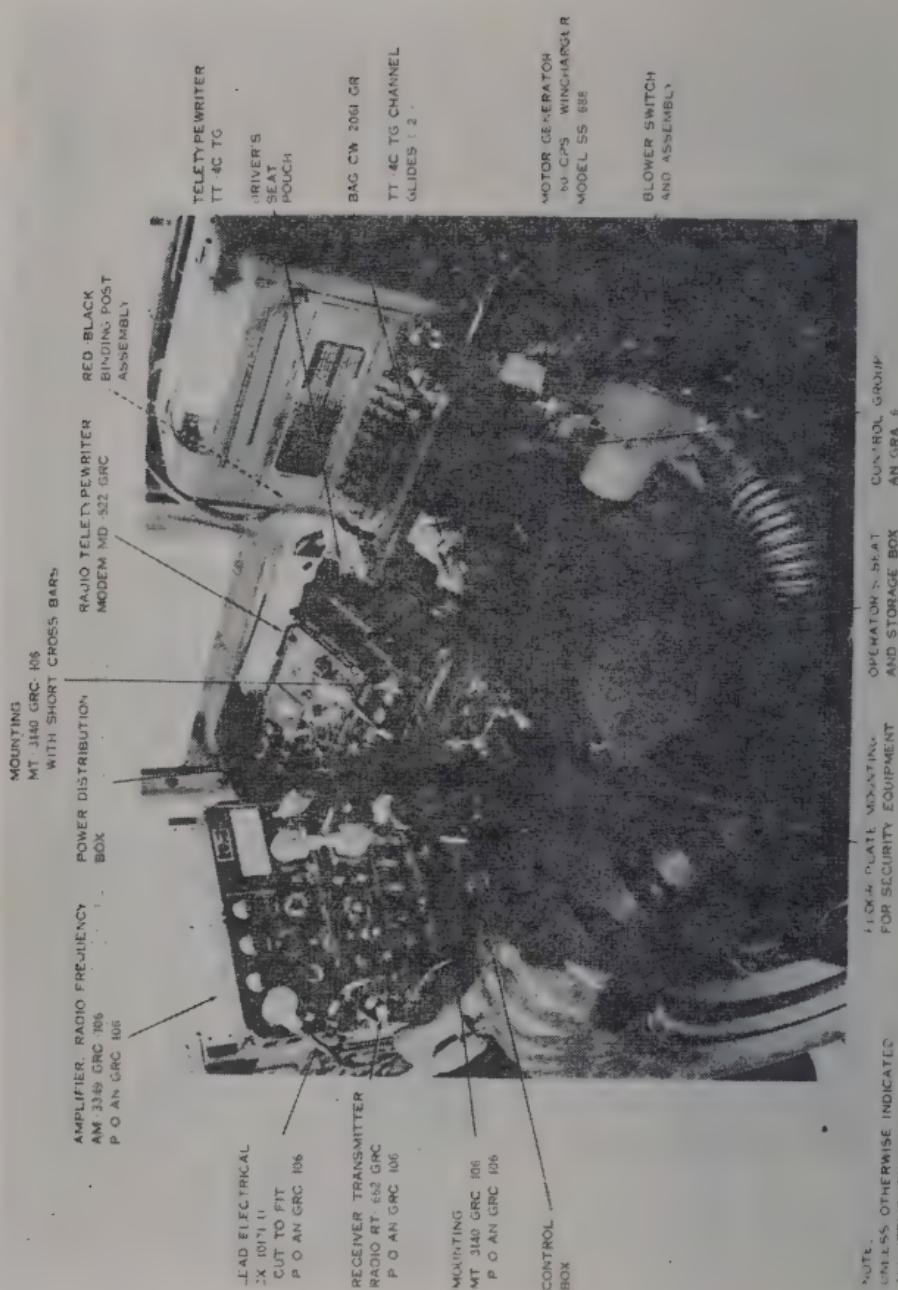
POWER DISTRIBUTION  
BOX

RECEIVER TRANSMITTER  
RADIO RT 652 GRC  
P O AN GRC 106

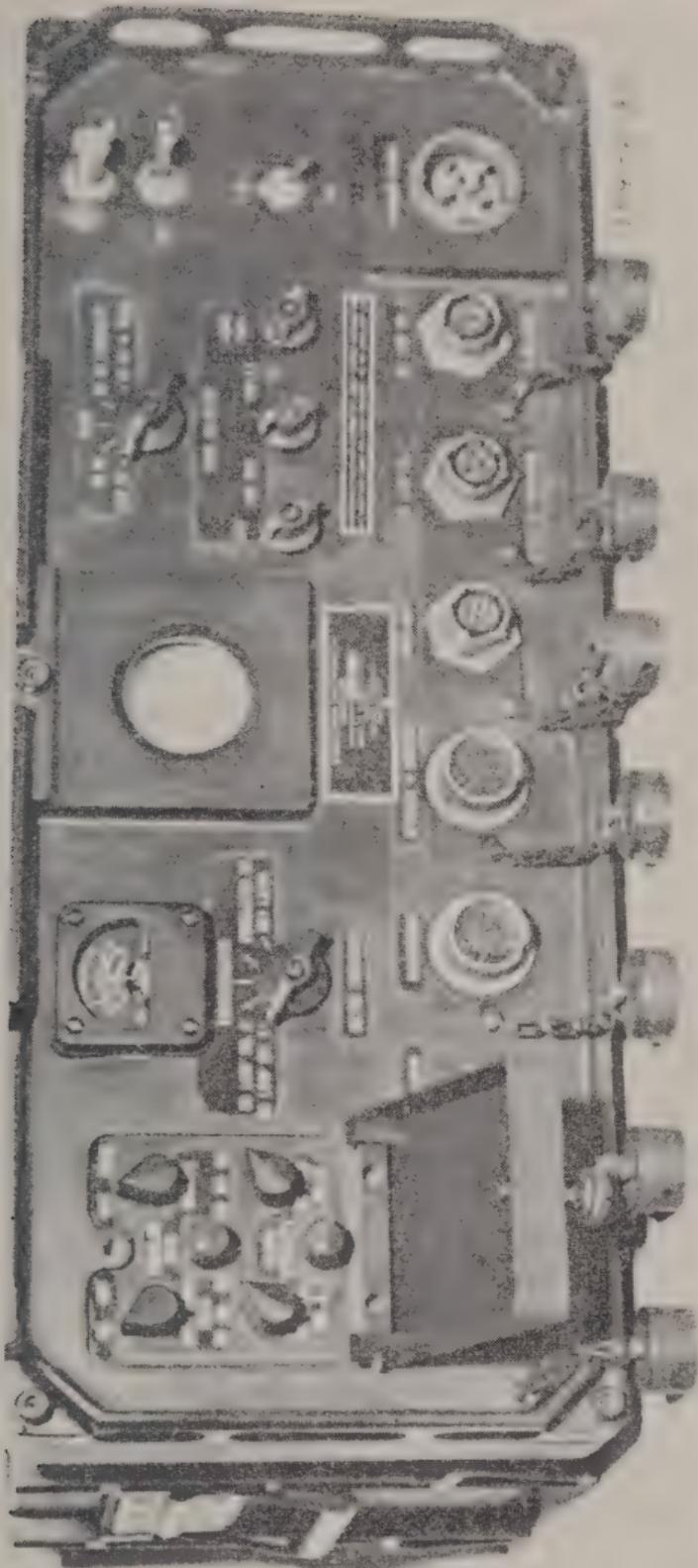
MOUNTING  
MT 3140 GRC 106  
P O AN GRC 106

CONTROL  
BOX

NOTE.  
UNLESS OTHERWISE INDICATED  
ALL ITEMS IDENTIFIED ARE  
PART OF THE INSTALLATION (INIT)



AN/VSC-2



MODEM MD-522



## CHAPTER 4. RADIO RELAY SYSTEMS AND EQUIPMENT

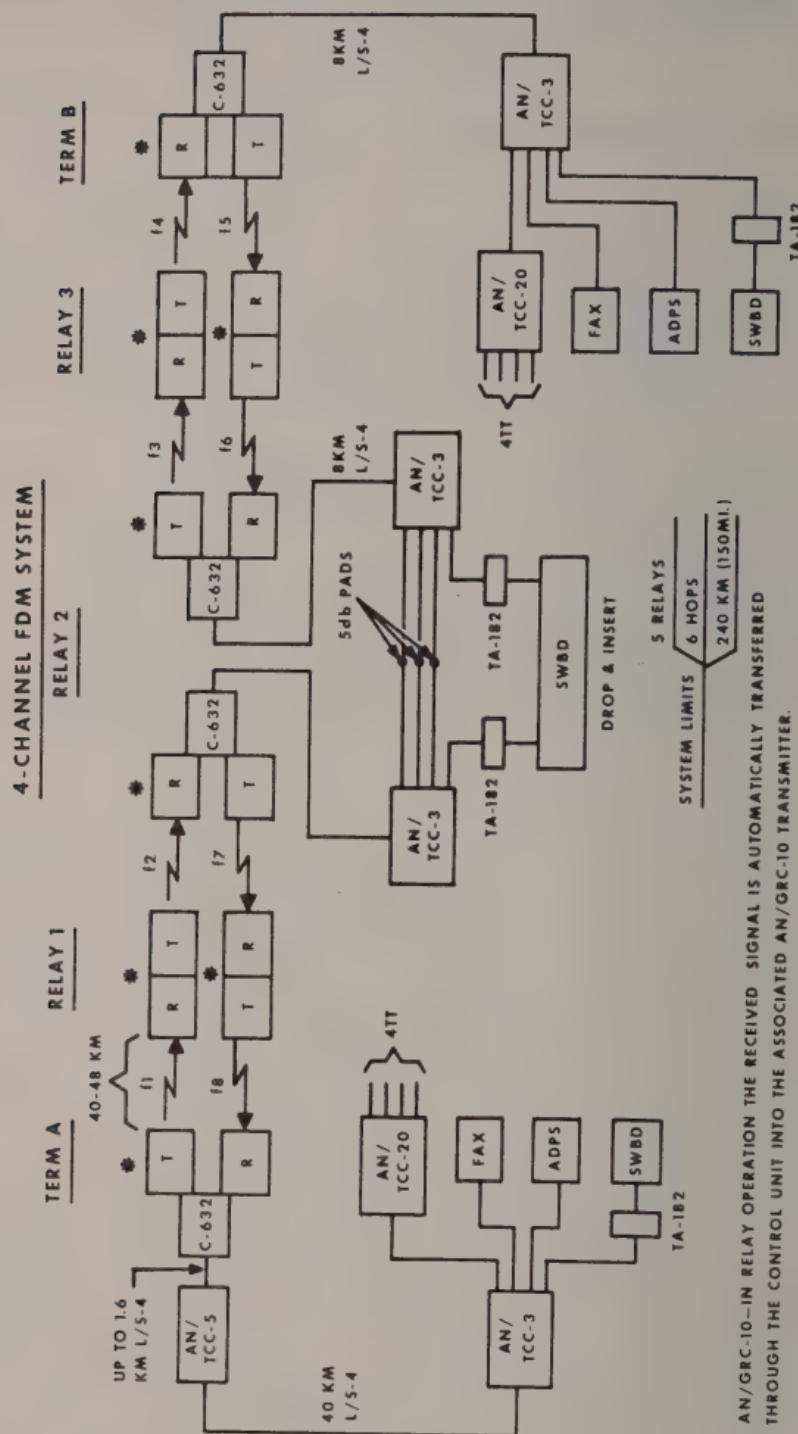
### Section I. RADIO RELAY SYSTEMS

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12-channel FDM system . . . . .	4-3
6/12 channel PCM system . . . . .	4-4
12/24 channel PCM system . . . . .	4-5

### Section II. RADIO RELAY EQUIPMENT

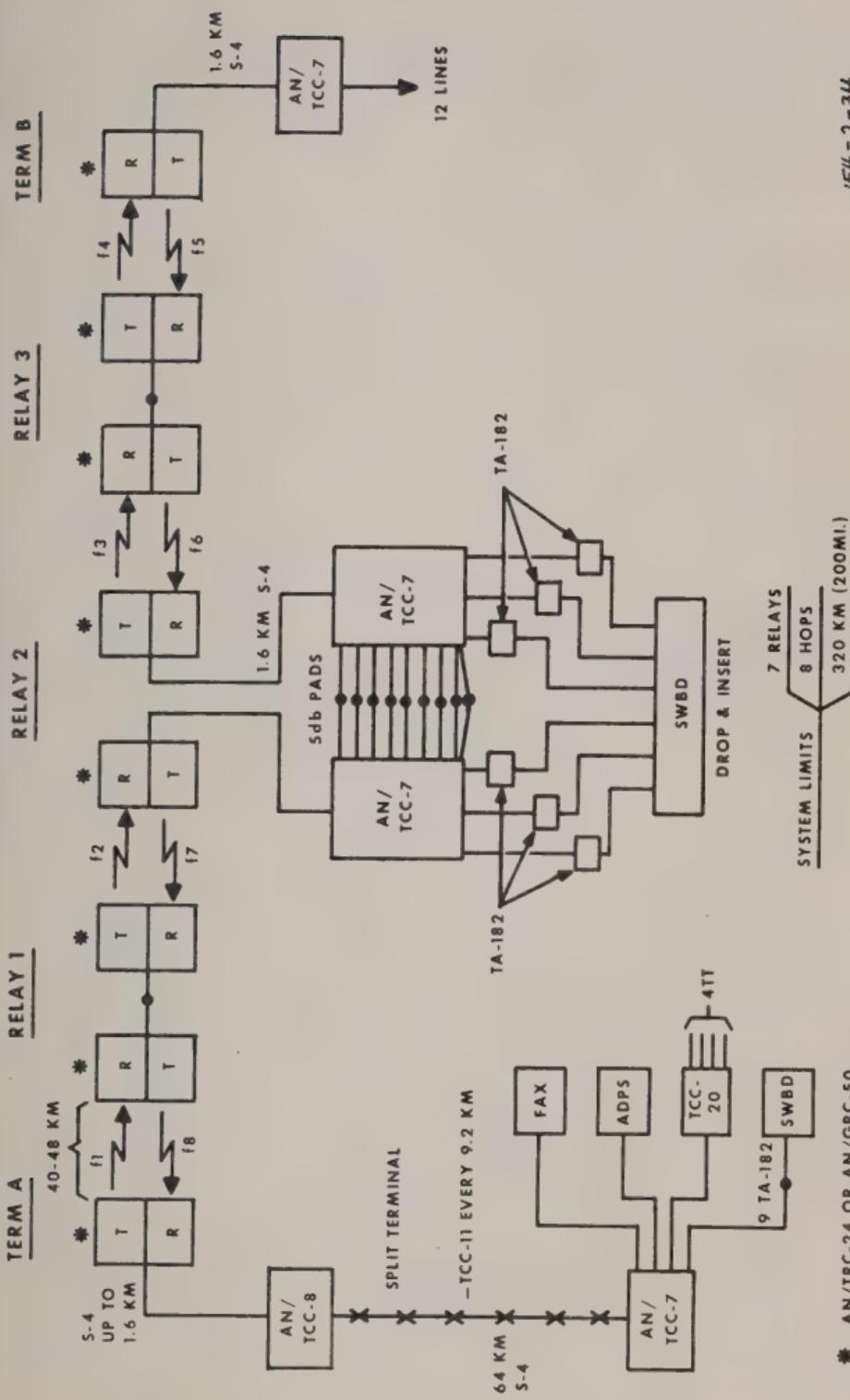
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Radio Set AN/GRC-163. . . . .	4-10
Radio Set AN/TRC-24. . . . .	4-12
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Radio Set AN/GRC-50 . . . . .	4-20

## Section I. RADIO RELAY SYSTEMS

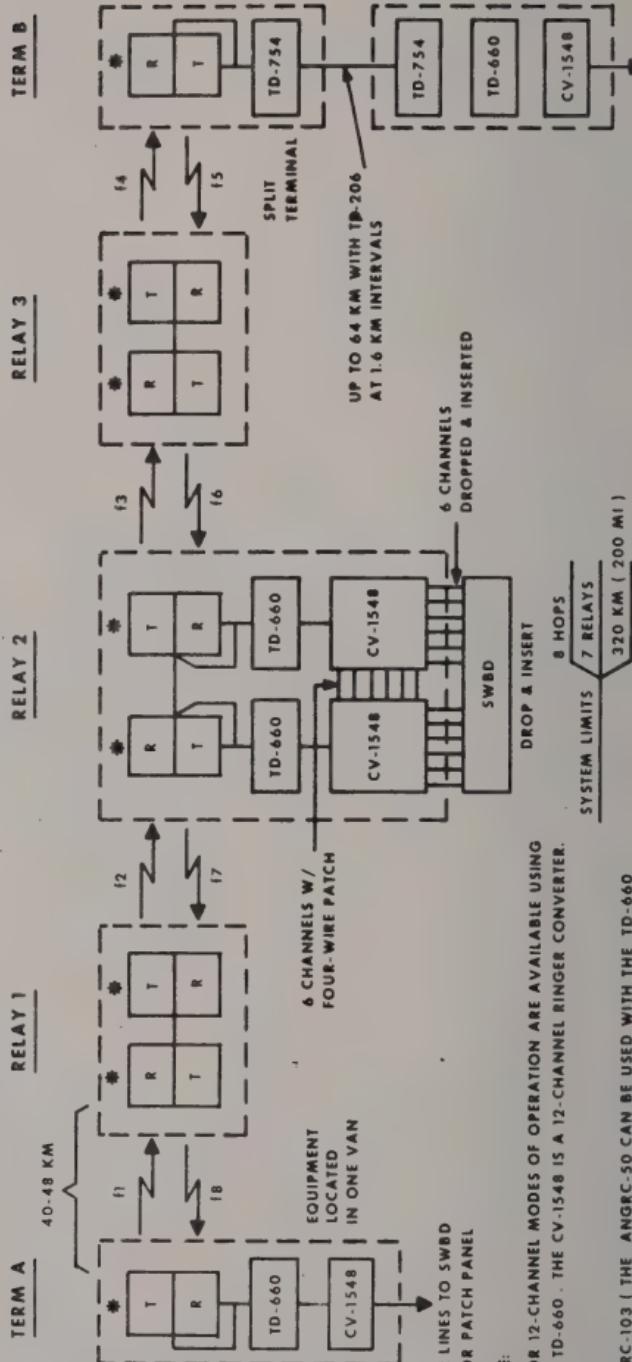


**# A/GRC-10-IN RELAY OPERATION THE RECEIVED SIGNAL IS AUTOMATICALLY TRANSFERRED THROUGH THE CONTROL UNIT INTO THE ASSOCIATED A/GRC-10 TRANSMITTER**

## 12-CHANNEL FDM SYSTEM



## LOW CAPACITY (6/12 CHANNEL) PCM SYSTEM



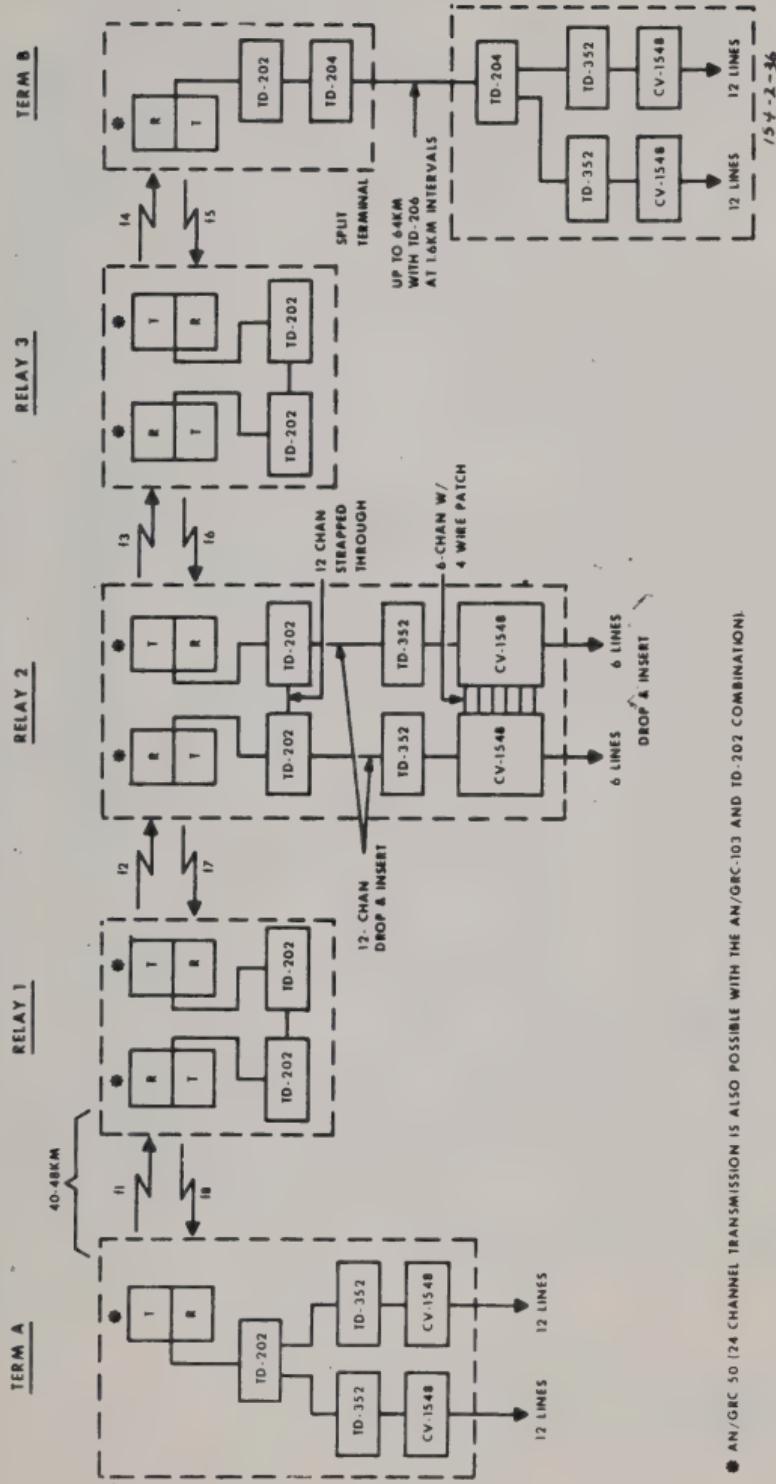
10

6-OR 12-CHANNEL MODES OF OPERATION ARE AVAILABLE USING THE TD-660. THE CV-1548 IS A 12-CHANNEL RINGER CONVERTER.

◆ AN/GRC-103 ( THE ANGRC-50 CAN BE USED WITH THE TD-660 IF A TD-202 IS USED AS INTERFACE BETWEEN THE AN/GRC-50 AND YLF MULTIPLEX SET).

12 LINES TO SWD

MEDIUM CAPACITY (12 / 24 CHANNEL) PCM SYSTEM



• AN/GRC 50 (24 CHANNEL TRANSMISSION IS ALSO POSSIBLE WITH THE AN/GRC-103 AND TD-202 COMBINATION)

## Section II. RADIO RELAY EQUIPMENT

### RADIO SET AN/GRC-10

STATUS: STD-A; FSN: 5820-552-8483

REF: TM 11-614 (AN/GRC-10, -39, -40)

TM 11-5820-505-15 (AN/MRC-68A)

#### GENERAL INFORMATION

The AN/GRC-10 is designated for use in portable, mobile, fixed or semi-fixed stations in conjunction with tactical wire carrier equipment to provide telephone, teletypewriter, facsimile, or data circuits. It may be used independently to provide a push-to-talk mode. The AN/GRC-10 is used primarily in the airborne and airmobile division radio relay systems.

#### TECHNICAL CHARACTERISTICS

Type of service: 80F9

Carrier: AN/TCC-3 (FDM)

Baseband: 20 kHz (250-20,000 Hz)

Frequency range: 54.0-70.9 MHz w/channel every  
100 kHz (170 channels)

Planning range: 40-48 km (maximum of 6 hops and  
5 relays, 240 km).

Power output: Lo-10 w; Hi-40 w.

Antenna: Ground plane or YAGI w/folded dipole  
on 40-ft mast

Power source: PE-75, PU-322/G

#### SPECIAL FEATURES

Frequency separation: Transmitter-receiver

1.0 MHz

Receiver-receiver

0.3 MHz

Transmitter-transmitter

0.3 MHz

Remote: Using AN/GRA-6

Automatic dc change-over.

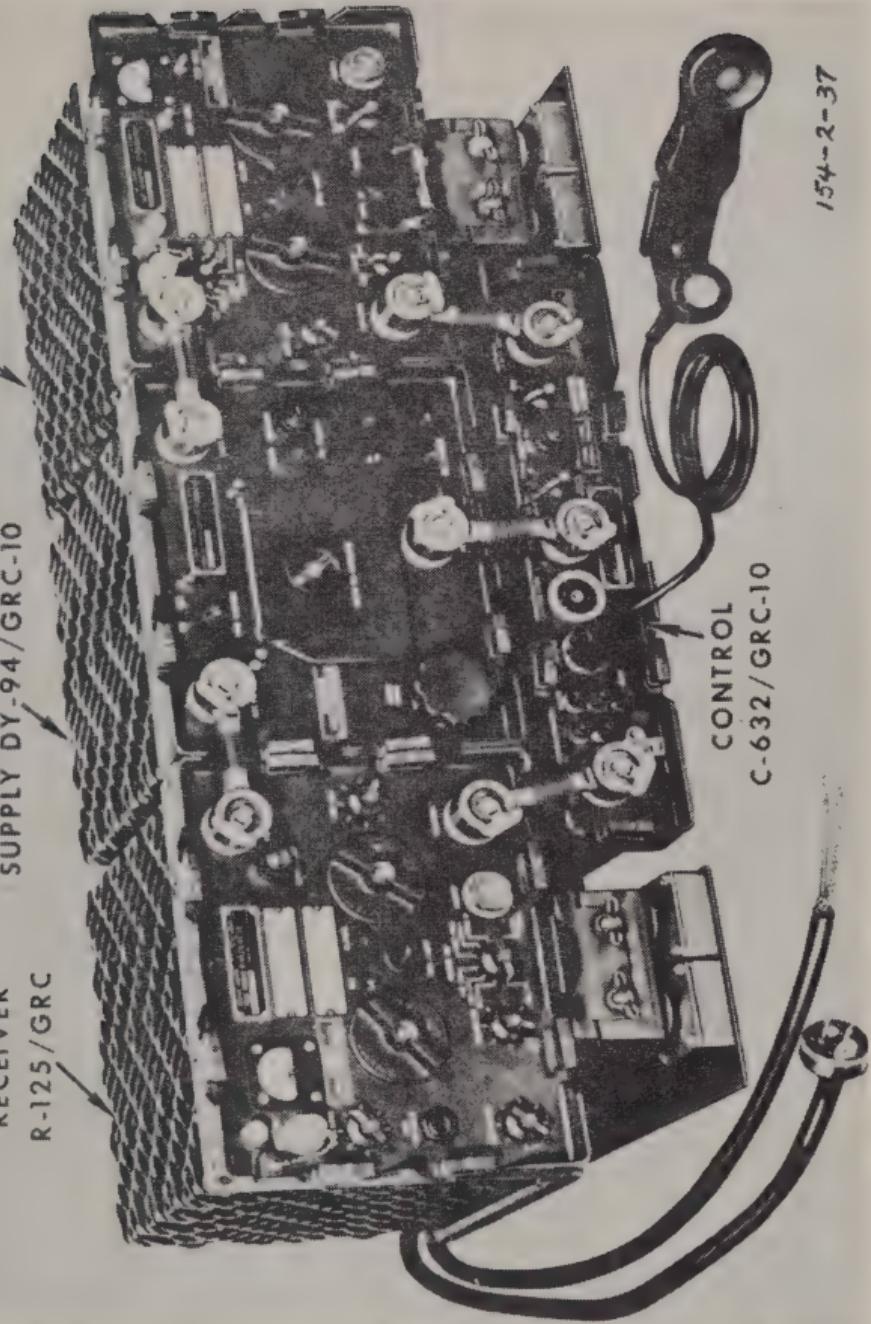
Weight: 150 lbs (GRC-10).

TRANSMITTER  
T-235/GRC-10

DYNAMOTOR POWER  
SUPPLY DY-94/GRC-10

RECEIVER  
R-125/GRC

CONTROL  
C-632/GRC-10



**AN/GRC-10**



**CONFIGURATIONS**

	AN/GRC-10	AN/TCC-3	Shelter	Weight
AN/MRC-68A	3	2	S-304	1,750 lbs
AN/MRC-111	2	1	1/4 ton tlr	
AN/MRC-112	2	2	1/4 ton tlr	
AN/GRC-39	2	-	-	300 lbs
7/GRC-40	3	-	-	450 lbs

## RADIO SET AN/GRC-163

STATUS: U FSN:5820-832-5617

REF: TM 11-5820-713-15

### GENERAL INFORMATION

The AN/GRC-163 is a compact, transportable, multichannel terminal set used in point-to-point radio circuits. It can provide four voice and two teletypewriter channels. Four telephone ringers are built into the AN/TCC-70. The radio components of the AN/GRC-163 consist of an RT-524 and an R-442 modified for wide-band operation.

### TECHNICAL CHARACTERISTICS

Type of service: 40F9

Carrier: AN/TCC-70

Frequency range: 30-75.95 MHz, 920 chan

Planning range: approx 50 mi (80 KM) (Log periodic antenna)

Power output: 3 w Lo, 35 w Hi; 70 w maximum

Antennas: 2 ea Log periodic AS-2169/G; 2 ea

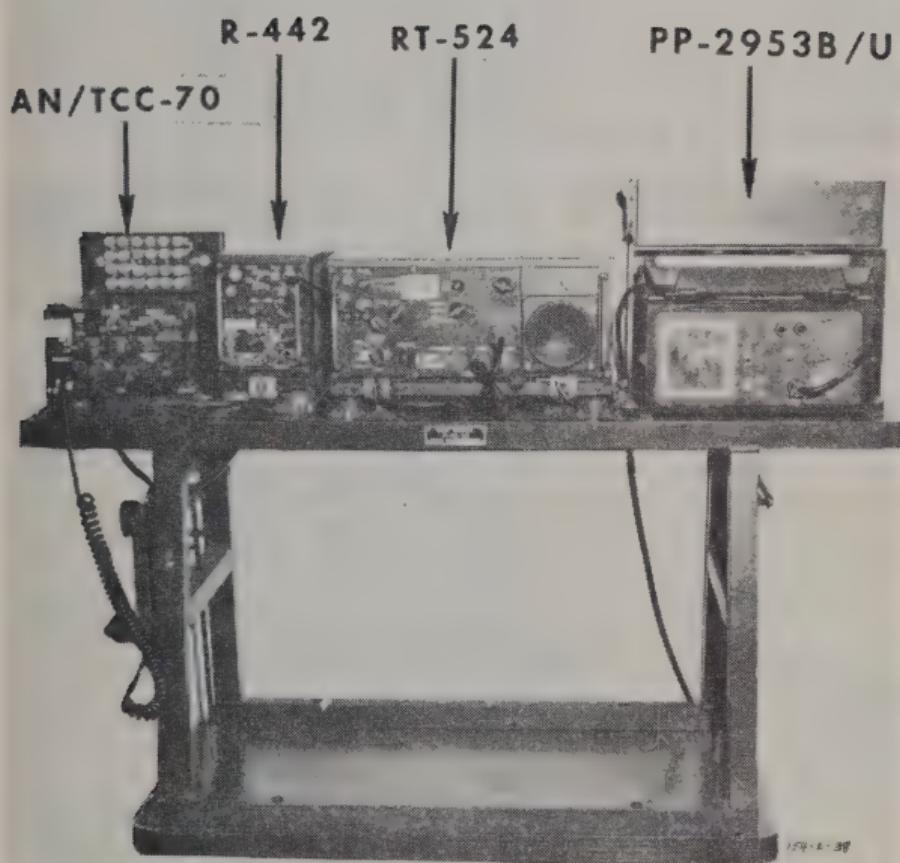
10 ft whip AS-1729 with groundplanes and mounting bracket which can be mounted on the AB-301 mast.

Power source: 1 ea SF 1.5 MD or any 115 v ac 60 Hz power source used in conjunction with integral PP-2953B/U

### SPECIAL FEATURES

1. R-442 requires installation of a wide-band filter FL 4001WB (FSN: 5915-879-5438).
2. R-442 and RT-524 must be set for X-mode operation.
3. Installation kits are available for installing the AN/GRC-163 in M-151A1 1/4-ton trucks and M-416 trailers.

Frequency separations: With vehicular mounted antennas: 10 MHz;  
With AS-2169 antennas mounted on AB-301 masts spaced 100 ft apart: 3 MHz.



## RADIO SET AN/TRC-24

STATUS: STD-A; FSN: 5820-532-3989

REF: TM 11-5820-287-12

### GENERAL INFORMATION

The AN/TRC-24 is a transportable, VHF-UHF radio set. The AN/TRC-24 is normally used in conjunction with terminals, telephone AN/TCC-3 (4 channels) and AN/TCC-7 (12 channels).

### TECHNICAL CHARACTERISTICS

Type of service: 200F9 (A band), 400F9 (B band),  
600F9 (C&D band), 750F9  
(F&J band)

Carrier: AN/TCC-3 (FDM); AN/TCC-7 (FDM).

Baseband: 68 kHz (250 to 68,000 Hz); 108 kHz  
(250 to 108,000 Hz, B model only)

Frequency range: A band: 50-100 MHz (200 chan  
in 0.25 MHz steps);  
B band: 100-225 MHz (250 chan  
in 0.5 MHz steps);  
C band: 225-400 MHz (175 chan  
in 1.0 MHz steps);  
D band: 400-600 MHz (133 chan  
in 1.5 MHz steps);  
F band: 790-965 MHz (350 chan  
in 0.5 MHz steps);  
J band: 1,350-1875 MHz (1,350  
chan in 0.25 MHz steps).

Planning range: 40-48 km; 7 relays, 8 hops

Power output: 10-120 w

Antennas: YAGI, A band

Plane reflector (AT-414) B-C-D bands.

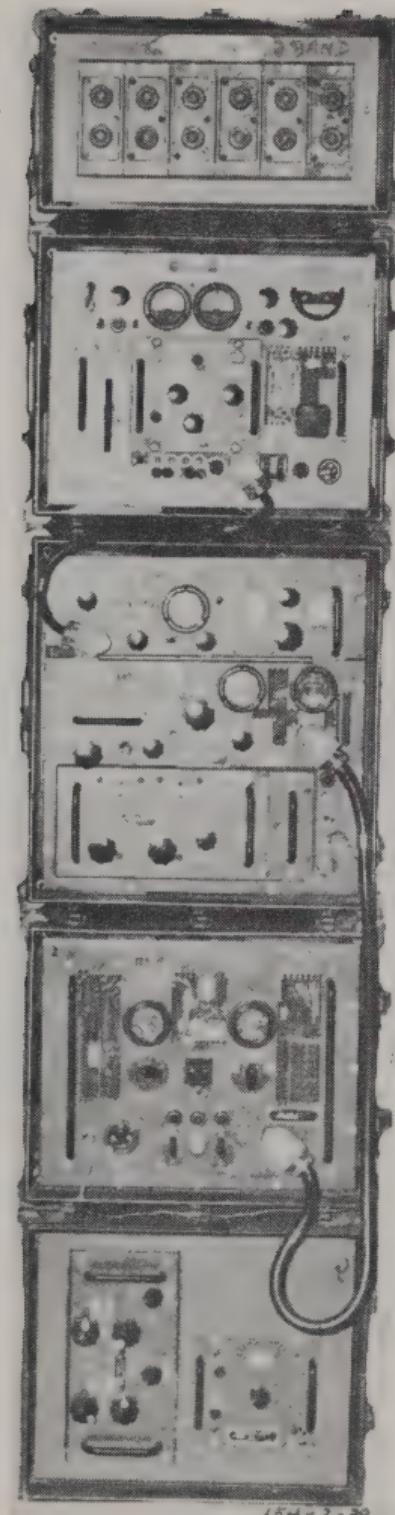
Ridge-loaded horn (AT-903) F&J bands.

Corner reflector (AT-880) B-C-D bands.

Power source: PU-286, PU-294, PU-474, PU-618,  
PU-619

### SPECIAL FEATURES

Weight: 473 lbs (TRC-24).



**BP filters**

**R-417**

**T-302**

**PP-685**

**Spare  
tuning  
heads**

**AN/TRC-24**

## CONFIGURATIONS

Equipment	MRC-69 TML	MRC-73 TML	MRC-54 RELAY
TRC-24	2	1	3
TCC-7	1	1	
TCC-50	1		
TCC-20		1	
TA-182	26	12	
F-98	12		
TH-5		1	
Level	Division	Corps & Army	All levels
Shelter	S-141	S-141	S-141
Vehicle	2-1/2-ton	2-1/2-ton	2-1/2-ton
Weight	7,500 lbs		6,200 lbs

## FREQUENCY SEPARATION

Freq band	Xmit/rec on same mast	Crossed polarized same mast	Near by under 0.4 km separation	1.6 km (1 mi) separation	Receivers
A	36 ch	Not possible	33 ch	5 ch	3 ch
B	36 ch	22 ch	22 ch	6 ch	2 ch
C	28 ch	11 ch	11 ch	3 ch	2 ch
D	27 ch	8 ch	8 ch	2 ch	1 ch

For F and J band refer to charts listed in TM 11-5820-287-12.

## RADIO SET AN/GRC-103

STATUS: D; FSN: 5820-935-4931

REF: TM 11-5820-540-12

### GENERAL INFORMATION

The AN/GRC-103 is a compact, transportable, multichannel radio set used in radio relay systems at division level and below. In issued configurations the AN/GRC-103 provides 6- or 12-channel service with its associated TD-660/G.

### TECHNICAL CHARACTERISTICS

Type of service: 500F9

Associated Carrier: TD-660 (PCM only)

Baseband: 240 kHz

Frequency range: Band I, 220-404.5 MHz

Band II, 394.5-705 MHz

Band III, 695-1000 MHz

Planning range: approx 50 mi (80 km)

Power output: 25 w

Antenna: Corner reflector (AS-1852. Mast AB-952 35' or 50' w/extension kit.

Power source: PU-625

### SPECIAL FEATURES

Automatic frequency control.

Frequency separation: 16.5 MHz transmit to receive.

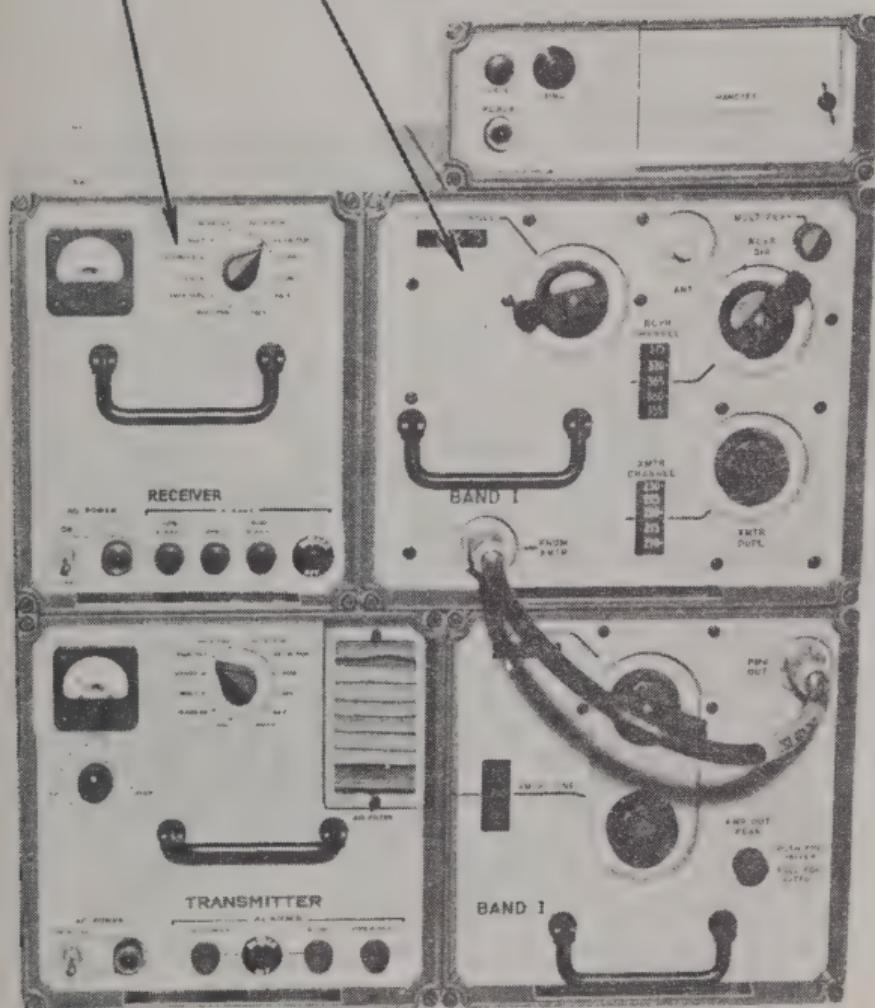
Duplexer in receive tuning head.

Weight: 150 lbs (GRC-103).

Low Capacity System.

R-1329 AM-4316

RT-773



T-983

AM-4320

AN/GRC-103



CONFIGURATIONS

Description	MRC-115 TML	MRC-126 TML	MRC-127 TML	TRC-113 RELAY	TRC-145 TML
GRC-103	2	1	2	3	2
TD-660	2	1	2		2
TD-754/204	Optional (1)	Optional (2)		3	2
CV-1548	2	1	2		2
Vehicle	1/4-ton tlr	Pallet 1/4-ton tlr	Pallet 1/4-ton tlr	1-1/4-ton	1-1/4-ton
Weight	1,900 lbs	1,550 lbs	2,050 lbs	1,945 lbs	2,150 lbs

## RADIO SET AN/GRC-50

STATUS: STD-A; FSN: Refer to TM  
REF: TM 11-5820-461-12

### GENERAL INFORMATION

The AN/GRC-50 is a medium-capacity, transportable, multichannel radio relay set used at corps and army level. In PCM configurations the AN/GRC-50 provides either 12- or 24-channel service. With FDM carrier equipment, the AN/GRC-50 can provide 4- and 12-channel service.

### TECHNICAL CHARACTERISTICS

Type of service: 1200F9.

Associated Carrier: TD-352 and AN/TCC-7.

Baseband: 240 kHz.

Frequency range: Low band, 601.5-999.5 MHz;  
High band, 1350.5-1849.5 MHz.  
(Channel every 1 MHz).

Planning range: 40-48 km.

Power output: Low band, 15-30 w.

High band, 8-20 w.

Antenna: Ridge-loaded horn (AT-903).

Power source: PU-618, PU-626.

### SPECIAL FEATURES

Automatic frequency control.

Frequency separation: 15 MHz transmit to receive.

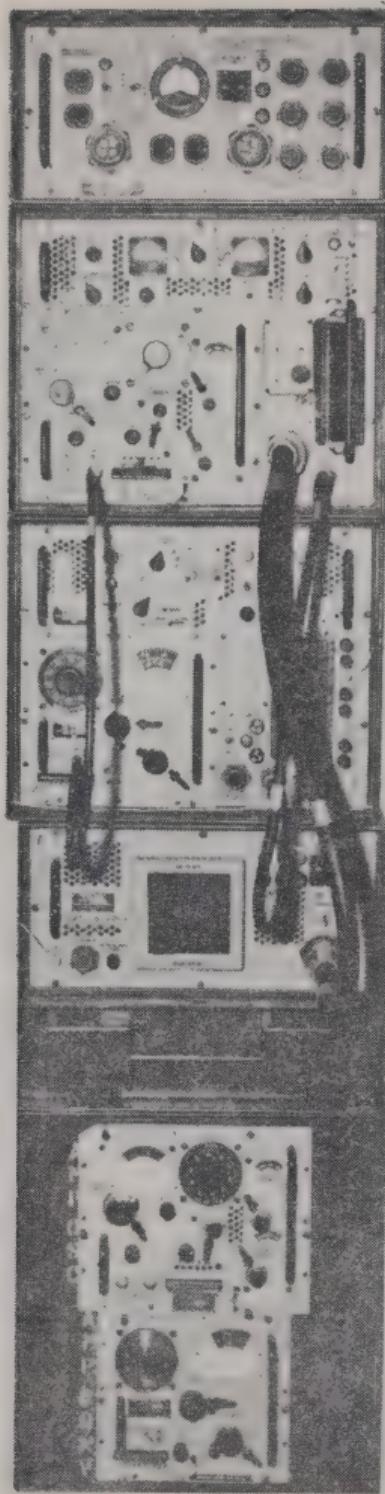
Duplexer in transmit tuning head.

Radio-carrier interface required in PCM operation.

Weight: 468 lbs (GRC-50).

Medium Capacity System.

CN-514



T-893

R-1331

PP-2054

AM-1958

AM-1956

AN/GRC-50

## 1. PCM

### CONFIGURATIONS

Description	TRC-108 TML	TRC-109 RELAY	TRC-110 RELAY	TRC-117 TML	TRC-143 TML
GRG-50	1	2	3	2	1
TD-352	1			2	1
TD-202	1	2	3	2	1
TD-204		2	3	2	
CV-1548	1			2	1
Vehicle	3/4-ton	3/4-ton	2-1/2-ton	2-1/2-ton	1-1/4-ton
Weight	1,882 lbs	1,957 lbs	5,150 lbs	5,080 lbs	2,110 lbs

## 2. FDM

Description	MRC-102 TML	MRC-103 RELAY
GRG-50	2	
TCC-7	1	
TA-182	12	
Vehicle	2-1/2-ton	2-1/2-ton
Weight	5,817 lbs	



**AT-903, Horizontal polarization**



## CHAPTER 5. MICROWAVE AND TROPOSPHERIC SCATTER SETS

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RADIO SET AN/TRC-29 AND ITS CONFIGURATIONS AS AN/TRC-38 thru AN/TRC-41

STATUS: STD A; FSN: 5820-925-6248(AN/TRC-29)  
5820-646-4757(AN/TRC-38)

STATUS: OBSL; FSN: 5820-646-4758(AN/TRC-39)  
5820-646-4759(AN/TRC-40)  
5820-646-4760(AN/TRC-41)

REF: TM 11-689, TM 11-2682

GENERAL INFORMATION

The AN/TRC-29 is a UHF, microwave radio relay set for use in field or fixed installations. It is capable of handling television, radar, FDM and TDM signals, and can operate in both the transmit and receive directions simultaneously with one antenna and RF transmission line. The RF transmission line used is a Surface Wave Transmission Line (SWTL) which has less attenuation than a coaxial cable. A separate order-wire receiver and transmitter, integrated with the main equipment, provides order-wire sub-carrier facilities on a party line basis. The AN/TRC-29 radio set does not include three components necessary for operation, namely the klystron, duplexer, and transmitter and receiver crystals. These must be ordered separately. The AN/TRC-29 is the basic radio set of the configurations below.

TECHNICAL CHARACTERISTICS

Configurations: Radio Terminal: AN/TRC-38, consisting of two AN/TRC-29's (one in use, one spare) and one multiplexer set AN/TCC-13. This allows termination of 23 channels of voice with one AN/TCC-13 or 45 voice channels using two AN/TCC-13's.

Radio Relay: All relay configurations now obsolete.

Radio Repeater Set AN/TRC-39: Three AN/TRC-29's (two in use, one spare). It operates as a straight through radio relay repeater. Radio Repeater

AN/TRC-40: Three AN/TRC-29 (two in use, one spare) and one AN/TRA-10, pulse form restorer. It provides pulse form restoration every 5th or 6th hop in the system, and provides drop and insert of channel 1 and 2, and is a relay. Radio Repeater AN/TRC-41: Same as AN/TRC-40, except it has AN/TCA-1 which drops and inserts channel 1 through 8.

Frequency range: 1.7 to 2.4 GHz (27 RF chan with 25 MHz spacing).

Types of Service: 9000F9, voice, teletypewriter, facsimile, data, television, radar.

Baseband: 30 Hz to 4.5 MHz

Input devices: AN/TCC-13 (PPM-TDM).

Transmitter range (km): 40 to 48

System limit: 960 km (600 miles) with 19 relays (20 hops) require pulse form restoration every 5th or 6th repeater using an AN/TRC-40 or -41 to restore the PPM signals to their original shape.

Antenna: 8 foot diameter, parabolic dish, wire mesh, 30 db gain vertical or horizontal polarization.

Surface wave transmission line: CG-1013/U: Used with system when distance from transmitter to antenna feed horn exceeds 100 feet.

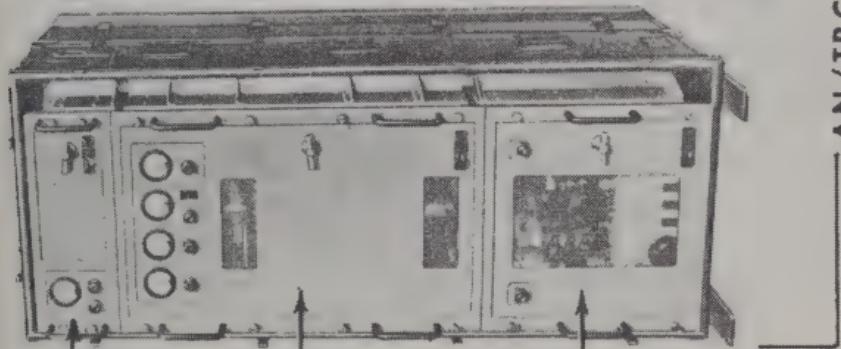
Power req: 115/230 v, 50-60 Hz, 2,300 w.

#### PHYSICAL CHARACTERISTICS

Transmitter Rack: 26 1/2 (h) x 27 (w) x 60 (d) in  
24.9 cu ft 517 lbs

Receiver Rack: 26 1/2 (h) x 27 (w) x 60 (d) in  
24.9 cu ft 534 lbs





RADIO SETS AN/GRC-67, AN/GRC-68,  
AN/GRC-147 AND RADIO REPEATER  
SET AN/TRC-111

STATUS: STD-A;

FSN: 5820-069-8857 (GRC-67)

5820-069-8878 (GRC-68)

STATUS: STD; 5820-935-0004 (GRC-147)

LP; 5895-868-8195 (TRC-111)

REF: TM 11-5820-568-12 (AN/GRC-147)

GENERAL INFORMATION

The AN/GRC-67, AN/GRC-68 and AN/GRC-147 radio sets are intermediate and rear-area microwave sets for use in the high capacity 48/96 PCM channel systems. The radio sets provide for multichannel, line-of-sight radio communication in the 4.4 to 5.0 gigahertz (GHz) frequency range. The radio sets when used with appropriate multiplex equipment can handle up to 96 channels of PCM or up to 12 channels of FDM. Radio Repeater AN/TRC-111 uses Radio Set AN/GRC-147 mounted in a 2-1/2 ton Shelter S-299/TRC-111 which provides facilities for a mobile repeater capability or terminal capability when used with a multiplex Telephone Terminal AN/TCC-62 or AN/TCC-73.

TECHNICAL CHARACTERISTICS

Type of service: 3000F9 (voice, teletype, data).

Frequency range: 4.4-5.0 GHz (78 channels with 2.5 MHz spacing).

Input: PCM-TDM, TD-353/U (48/96 channels).  
FDM, AN/TCC-7 (12 channels).

Planning range: 40-50 km (30miles, average)

Transmitter power: 1.0 w (minimum)

Antenna: 4.5 ft horn-fed parabolic reflector.

The 4.5 ft antenna is mounted on Mast Assembly AB-621/G (sectionalized, aluminum, and can be erected to 50 feet using the handcrank mechanical launcher).

Flexible waveguide sections are used from the 4.5 ft antenna to the radio set or equipment shelter. 33 db minimum gain.

Power req: 120V  $\pm$  5% 47-420 Hz, 1 KW/Radio Set  
Power source: PU-631/G. (single phase)

Configurations: Radio Set AN/GRC-67 consists of one complete transmitting system (including order-wire) and one complete receiving system. Radio Set AN/GRC-68 consists of two complete transmitting systems (including order-wire) and two complete receiving systems. Radio Set AN/GRC-147 consists of three complete transmitting systems (including order-wire) and three complete receiving systems. AN/TRC-111 consists of three 48-96 channel systems in a 2-1/2 ton vehicle. Repeater or terminal capability when used with multiplex telephone terminal AN/TCC-62 or AN/TCC-73.

#### PHYSICAL CHARACTERISTICS

1 Transmitter Equip Cabinet Rack:

[66 1/10 (h) x 22 1/10 (w) x 22 1/10 (d)] in, 420 lbs

1 Receiver Equip Cabinet Rack:

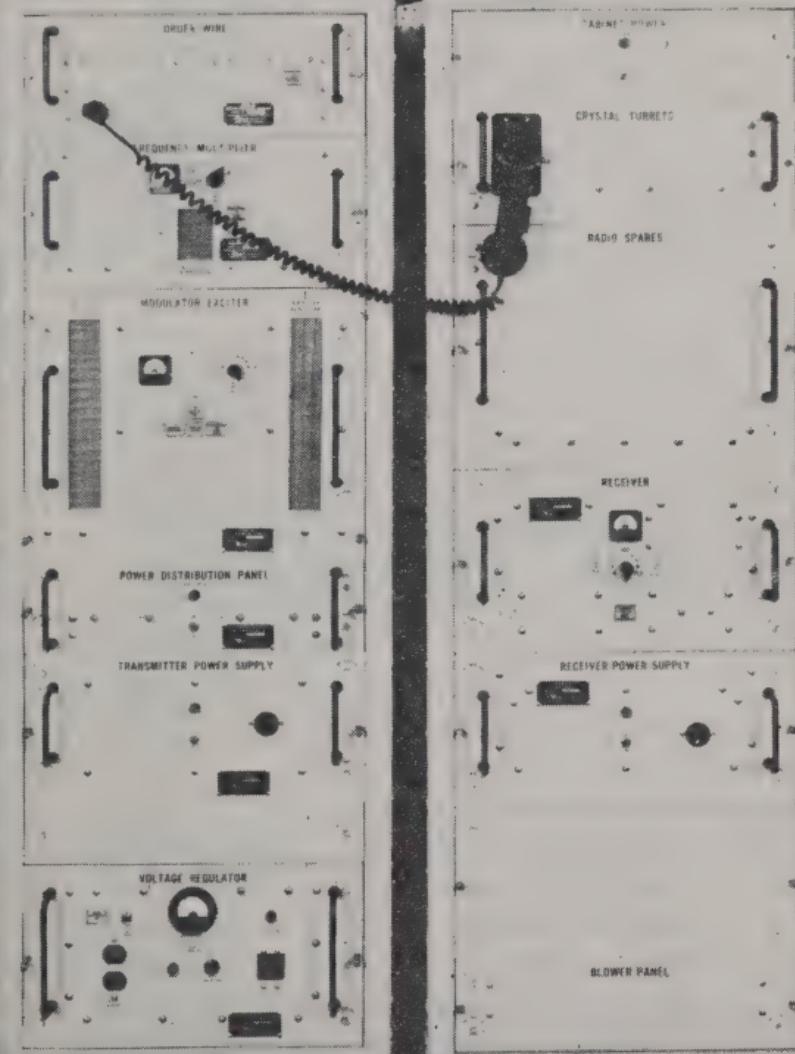
[65 6/10 (h) x 22 1/10 (w) x 22 1/10 (d)] in, 320 lbs

AN/GRC-67 740 lbs; AN/GRC-68 1220 lbs;

AN/GRC-147 1980 lbs.

Note: These radio sets are intended for interim use and will be replaced by the AN/GRC-144, AN/TRC-138 family of radio sets. The AN/GRC-144 is not compatible with the AN/GRC-147.





154-2-44

**AN/GRC-67**

## RADIO SET AN/GRC-144 AND RADIO REPEATER SET AN/TRC-138

STATUS: LP; FSN: 5820-926-7357 (GRC-144)  
LP; FSN: 5820-133-8841 (TRC-138)

REF:

### GENERAL INFORMATION

Radio Set AN/GRC-144 is an extremely compact tactical line-of-sight (FM) microwave radio. The equipment is completely transistorized and modulized. The AN/GRC-144 is capable of handling FDM multiplexing equipment, but was designed to be utilized with Multiplexers TD-352/U and TD-353/U PCM equipment. The order-wire modem (300-1800 Hz) is part of the main transmitter T-1054/GRC. A PCM radio combiner modem option panel is mounted in the transmitter cabinet which eliminates the need for PCM multiplexer radio combiners TD-202/U and TD-203/U. The major components of the AN/GRC-144 are:

- 1 each Transmitter Radio T-1054/GRC
- 1 each Receiver Radio R-1467/GRC

### TECHNICAL CHARACTERISTICS

Frequency range: 4.4 to 5.0 GHz (6001 RF channels w/100 kHz spacing).

Input devices: 48/96 channel PCM or FDM.

Transmitter power: 1/4 w

Planning range (km): 80 (50 miles)

Antenna: 4.5 foot horn-fed parabolic reflector.

The 4.5 ft antenna is mounted on a sectionalized, aluminum mast assembly and can be erected to 50 ft using the handcrank mechanical launcher.

Flexible waveguide sections are used from the 4.5 ft antenna to the radio set or equipment shelter.

Power req: 115/230 v ac; 47.5 to 63 Hz, single phase.

Configurations: AN/TRC-138 three (3) separate AN/GRC-144 microwave radio sets, each capable of (48/96) channel) PCM input in 1 each S-393/TRC-138 shelter on 2-1/2 ton vehicle.

Note: PCM multiplex equipment is housed in telephone terminal shelter, such as the AN/TCC-62.

#### PHYSICAL CHARACTERISTICS

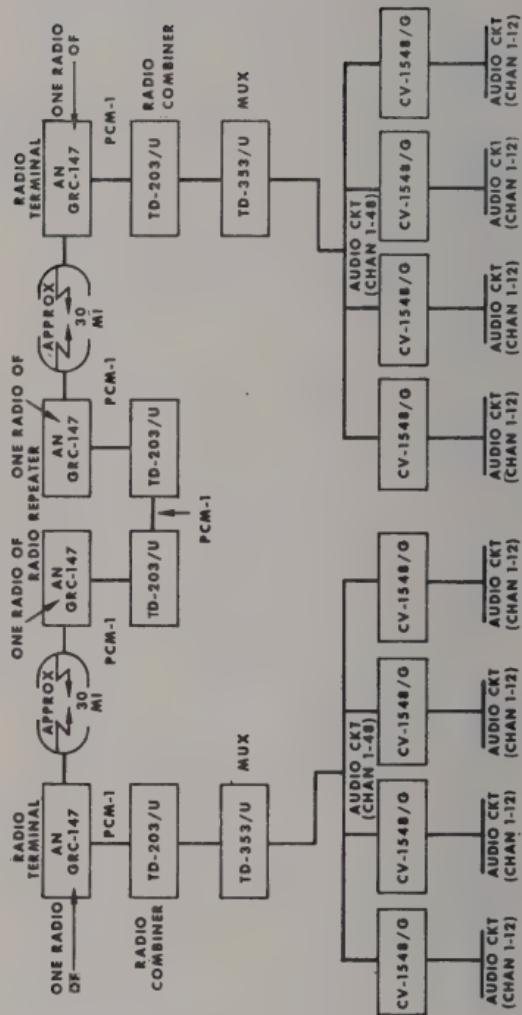
Transmitter T-1054:

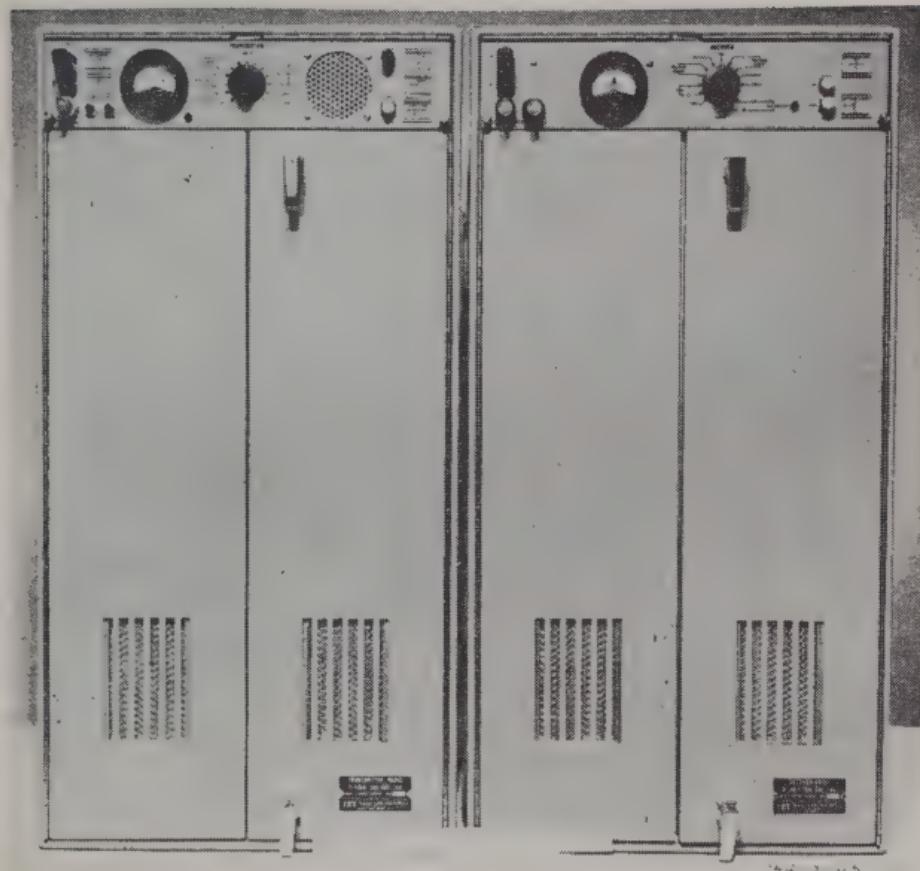
33 (h) x 17 (w) x 14 (d) inches      165 lbs.

Receiver R-1467:

33 (h) x 17 (w) x 14 (d) inches      135 lbs.

## **FOURTY-EIGHT CHANNEL TDM-PCM RADIO SYSTEM RADIO SET AN/GRC-147**





**AN/GRC-144**

# RADIO TERMINAL SET AN/TRC-80

STATUS: LP; FSN: 5820-168-1557

REF: TM 11-5820-469-10

## GENERAL INFORMATION

The AN/TRC-80 is a tropospheric scatter, radio communication facility capable of duplex transmission and reception of one voice channel and one radio teletypewriter circuit. The AN/TRC-80 was one of the first tactical tropospheric scatter radio sets to be adopted by the US Army and is the forerunner of the AN/TRC-90 series radio sets.

## TECHNICAL CHARACTERISTICS

Frequency range: 4.4-5.0 GHz (333 RF chan w/ 1.8 MHz spacing).

Input device: Demultiplexer-Multiplexer TD-550/TRC-80.

Transmitter power (w): 1,000.

Planning range (km): Nondiversity operation -- 112 km (70 miles)  
Diversity operation -- 160 km (100 miles)

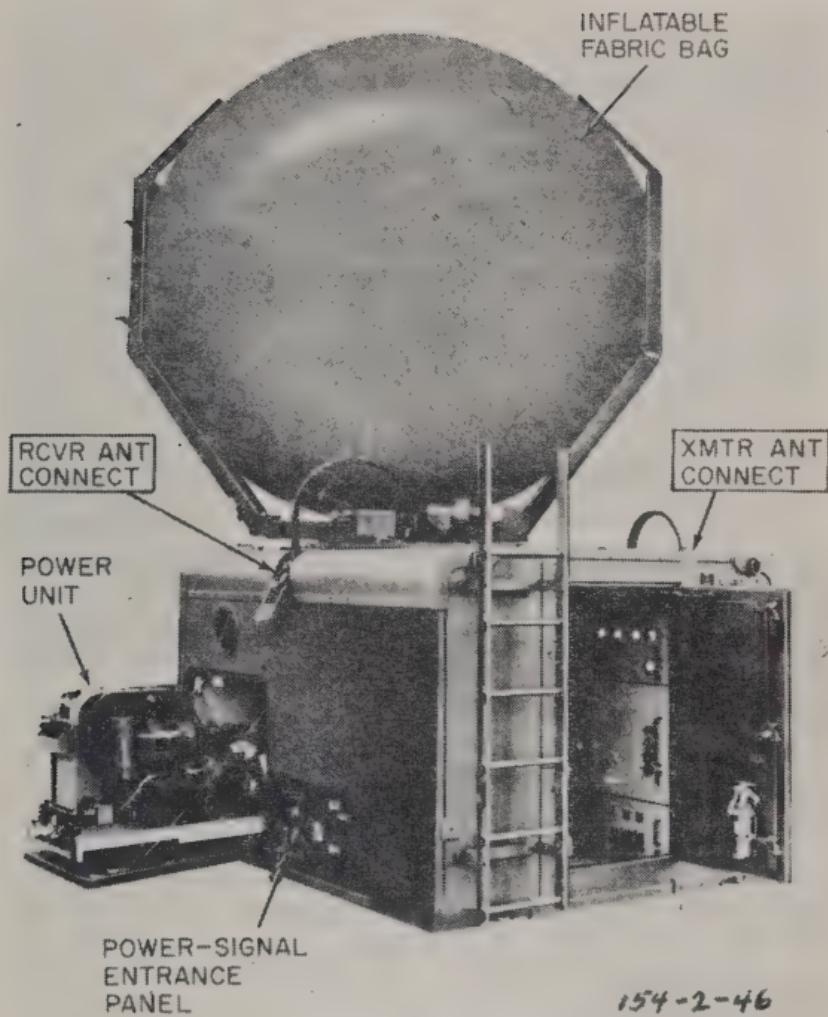
Antenna: 8 ft inflatable parabolic reflector with bipolarized feed horn mounted on top of shelter (S-254/TRC-80).

Power req: 208/120 v, 400 Hz, 3-phase, 4-wire.

Power source: Gasoline engine driven alternator (10 kw), part of shelter.

Frequency separation: 100 MHz between xmtr and rcvr.

Note: The AN/TRC-80B modified the AN/TRC-80 to utilize four 2 wire / 4 wire multiplexed telephone circuits. The four circuits can be used for voice on TTY or a combination of both.



154-2-46

AN/TRC-80

## RADIO TERMINAL SETS AN/TRC-90 AND AN/TRC-129(SERIES)

STATUS: STD-A;

FSN: 5820-892-3748 (TRC-90)

FSN: 5815-953-9722 (TRC-90A)

FSN: 5820-078-3958 (TRC-90B)

FSN: 5895-869-6258 (TRC-129)

FSN: 5895-935-0113 (TRC-129A)

REF: TM 11-5820-512-12 (TRC-90)

TM 11-5820-524-12 (TRC-90A)

TM 11-5820-519-12 (TRC-90B; TRC-129)

TM 11-5820-726-12 (TRC-129A)

### GENERAL INFORMATION

The AN/TRC-80 Terminal Set was modified to be used as a multichannel communications facility and was the forerunner of the AN/TRC-90 and AN/TRC-129 series terminal sets. Radio Terminal Sets AN/TRC-90, -90A, -90B and AN/TRC-129, -129A are self contained SHF tropospheric scatter air and ground transportable communications terminals. The AN/TRC-90/TRC-129 terminal sets consist of a basic radio system of one transmitter and two receivers and two parabolic antennas for space diversity reception of signals. The differences in models from AN/TRC-90 through AN/TRC-129A are in signaling, antennas utilized, and state-of-art improvements made in the multiplex and basic radio sets. The latter models incorporated newer transistorized components, better tunnel diode amplifiers, and a broader IF baseband for more channel capability.

The Multiplex Unit MX-106, part of the TRC-90/TRC-129 shelter has a traffic capability of 24 voice channels and 1 order-wire channel. A voice-frequency teletype terminal (VFTG), part of the TRC-90/TRC-129 shelter is a 16 full duplex channel frequency shift keying type (FSK). The VFTG accepts up to 16 dc TTY signals from external circuits and converts them to voice frequency

tones. The 16 VF tones are combined and the composite signal is applied to one VF channel of the MX-106 Multiplex Unit (normally channel 12). The order-wire channel can simultaneously transmit and receive both voice and teletypewriter signals. The order-wire teletypewriter is a standard keyboard page printing model.

A separate auxiliary HF, single-sideband transceiver with an output power of 100 w (PEP) is provided for communications during initial setup and installation of the radio terminal sets. Each radio terminal set is contained in a modified S-141-G shelter.

#### TECHNICAL CHARACTERISTICS

Baseband: 12 kHz to 106 kHz.

Frequency range: 4.4-5.0 GHz (12000 RF chan w/0.5 MHz channel spacing).

Input device: Multiplex Unit MX-106 (FDM) (twenty four 2 or 4 wire voice circuits, or twenty three voice circuits and 16 teletype signals on one voice frequency circuit).

Transmitter power (w): Nominally 1,000 w.

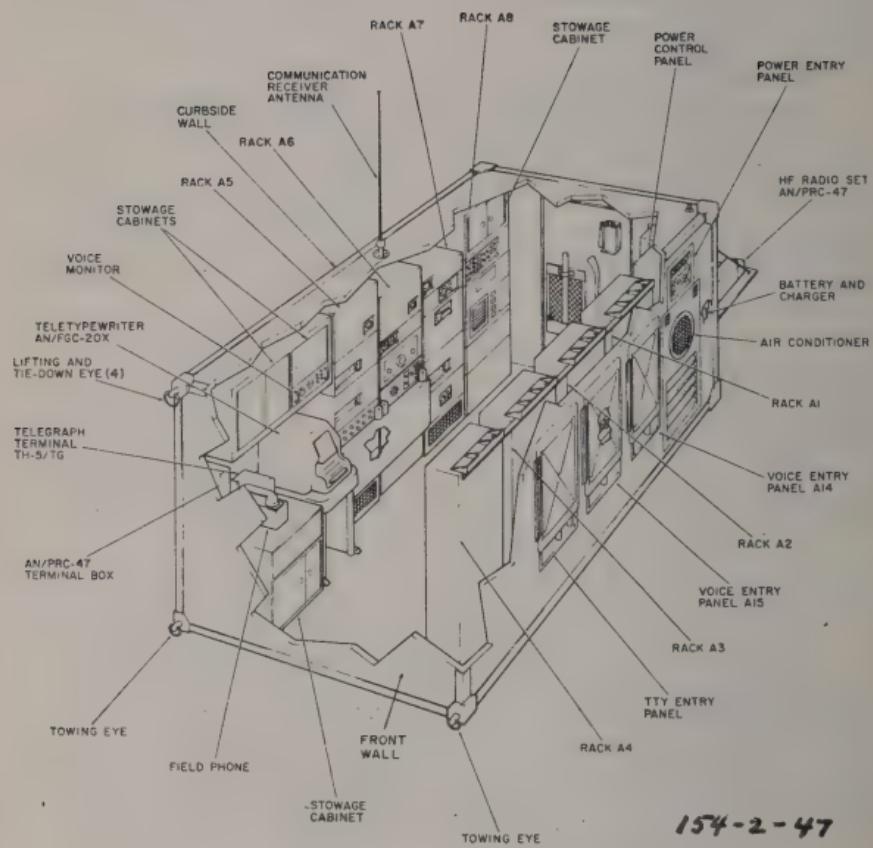
Planning range (km): 250 km (150 miles)

Antennas: 15 ft air-inflatable parabolic reflector with silverized cloth surface (AN/TRC-90).

10 ft parabolic reflector with center height of reflector 15 ft above ground when installed (AN/TRC-90A) and AN/TRC-129).

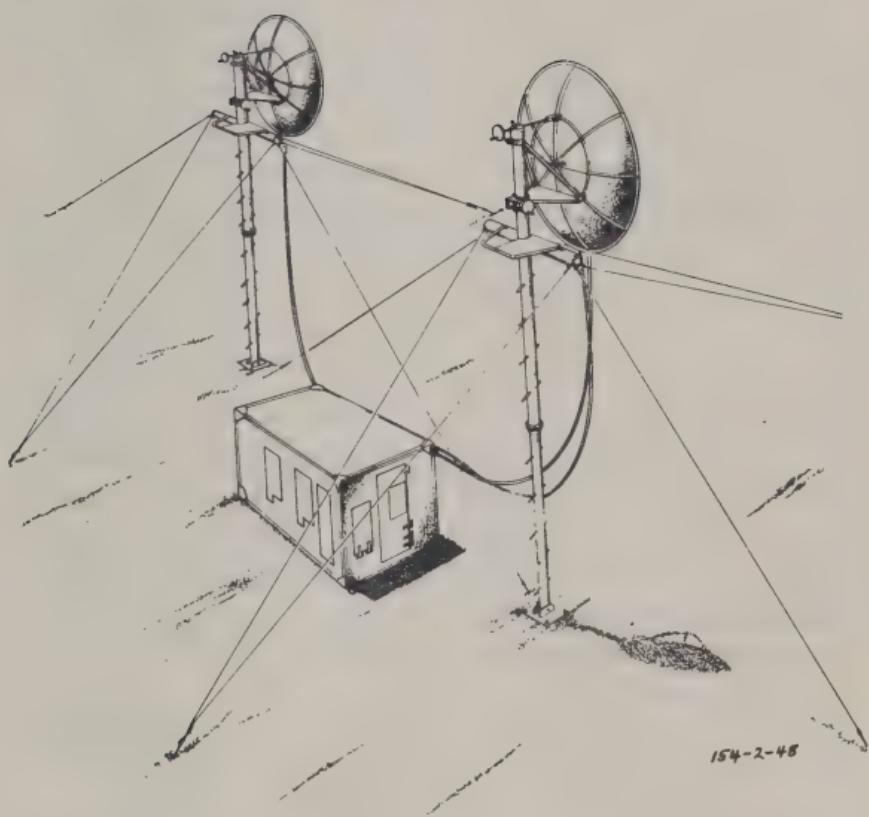
29 ft parabolic reflector mounted on aluminum tower/trailer for transportation (AN/TRC-90B and AN/TRC-129A).

Power req: 208 v ac, 3 phase, 4 wire, 60 Hz, 15 kw.



154-2-47

AN/TRC-90



**AN/TRC-90 series**

**RADIO TERMINAL SETS AN/TRC-132  
AND AN/TRC-132A**

**STATUS: STD-A; FSN: 5820-999-4364 (TRC-132)  
(TRC-132A)**

**REF: TM 11-5820-607-12 (TRC-132)**

**GENERAL INFORMATION**

Radio Set AN/TRC-132 is a tropospheric communications system which has components similar to those in the AN/TRC-90B/TRC-129 series radio terminal sets. The AN/TRC-132 has the necessary equipment for quad diversity option (two complete transmitters and four receivers) and 48 channel operation using Multiplex MX-106, all in one 2-1/2-ton shelter. The AN/TRC-132 has no internal Voice Frequency Telegraph Terminal (VFTG) capability. Radio Terminal Set AN/TRC-132A, formerly known as the AN/TRC-132 (V), is a heavy-route tropospheric scatter communications system. It consists of two modified S-280/G (2-1/2-ton) vans. The first van houses the MX-106 with capabilities for 60 voice channels, one AN/FCC-19 which provides 16 channels of teletype multiplexing, four receivers and two complete transmitter-exciters. The second van contains two 10 kw power amplifiers and a complete liquid heat exchange system.

**TECHNICAL CHARACTERISTICS**

**Frequency range: 4.5-5.0 GHz (12000 RF chan  
w/0.5 MHz spacing)**

**Transmitter power: 1 kw (TRC-132)  
10 kw (TRC-132A)**

**Input devices: 48 voice channels, no TTY  
(AN/TRC-132).**

**60 voice channels or 59 voice plus  
16 channels of TTY (AN/TRC-132A).**

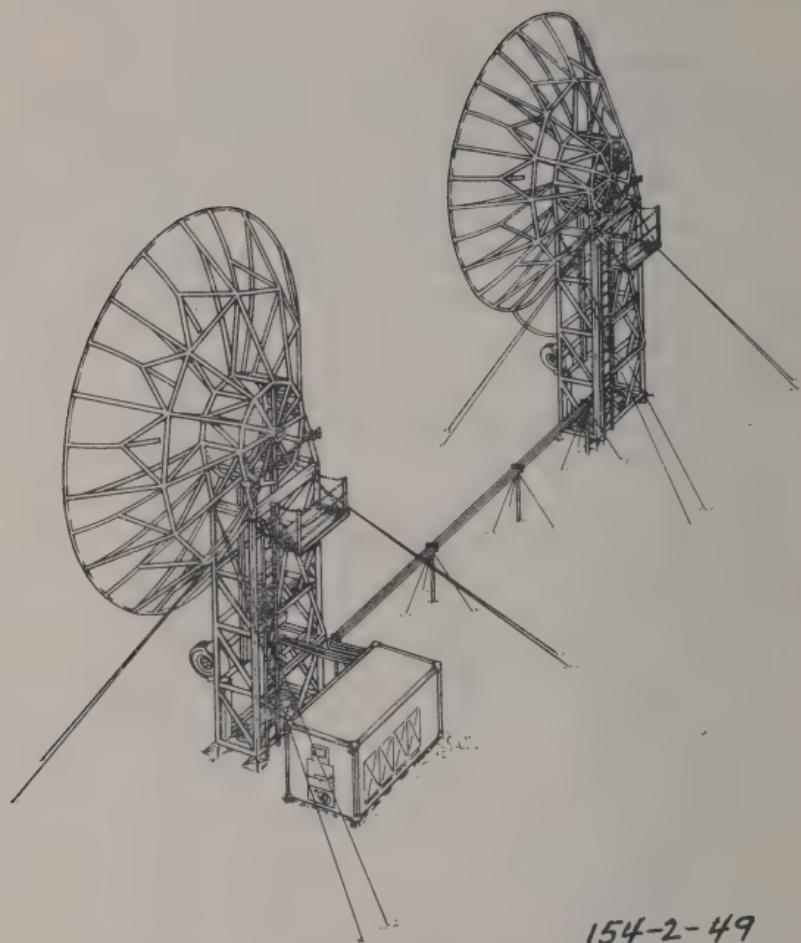
**Planning range: Up to 100 miles (TRC-132)  
200-300 miles (TRC-132A)**

Antenna: 28 foot parabolic reflector mounted on aluminum tower/trailer (TRC-132) same as TRC-90B antenna.

29 foot parabolic reflector mounted on a tripod base (similar to US Air Force AN/MRC-98 antenna system).

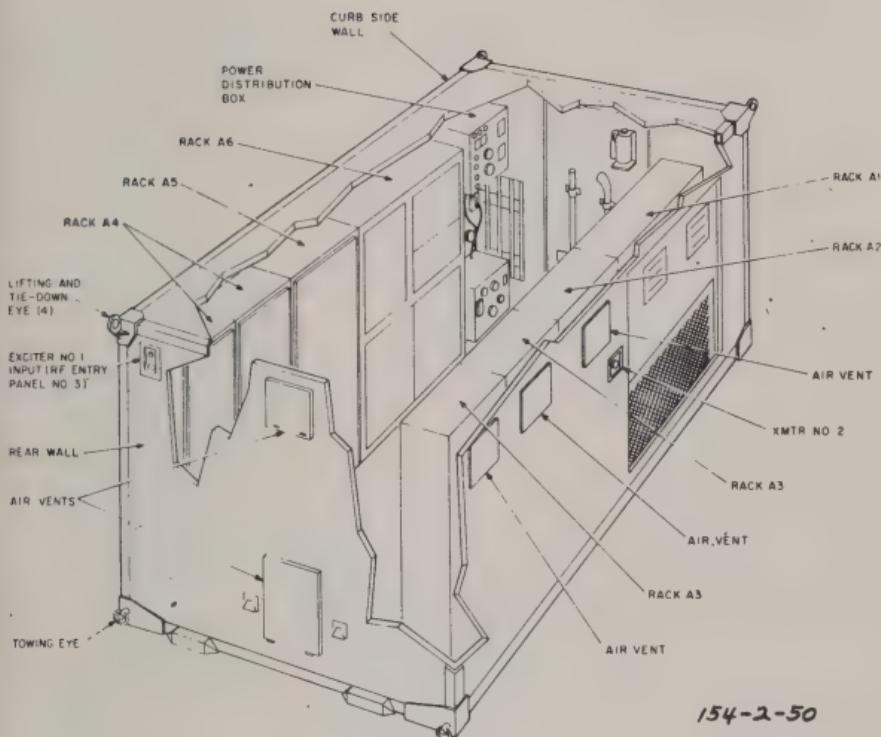
Base folds to become trailer transporter for movement (AN/TRC-132A).

Power req: AN/TRC-132 and TRC-132A, Basic Equipment Shelter, 208 v ac, 3 phase, 4 wire, 60 Hz at 15 kw.  
AN/TRC-132A, Power Amplifier Shelter, 208 v ac, 3 phase, 4 wire, 60 Hz, at 100 kw.



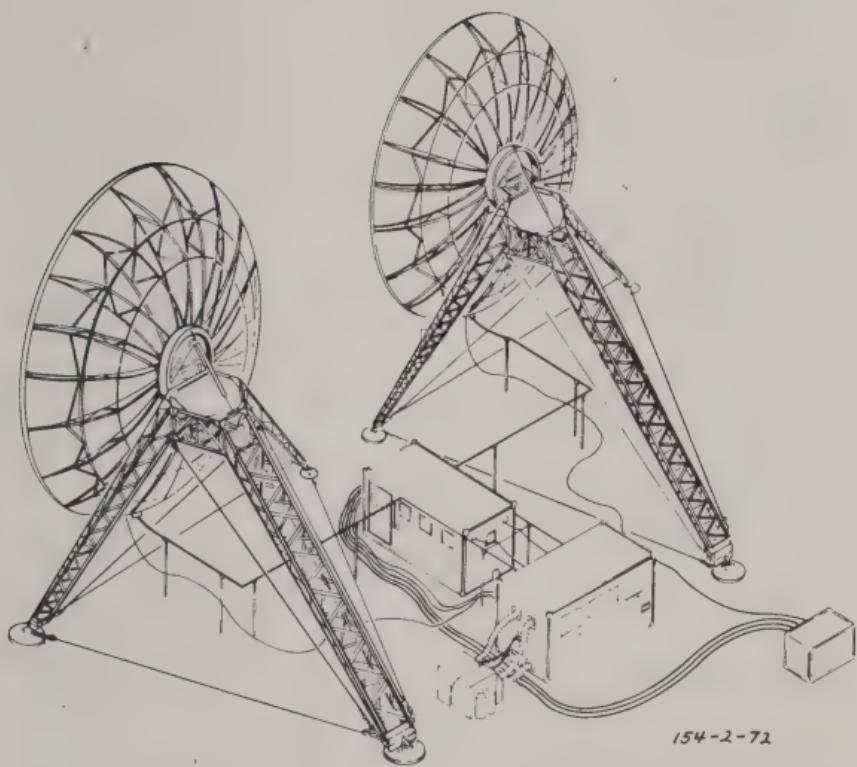
154-2-49

**AN/TRC-132**



**AN/TRC-132**





154-2-72

**AN/TRC-132A**

# RADIO TERMINAL SET AN/TRC-97B

STATUS: LP; FSN: 5820-072-5915

REF: TM 11-5820-738-13

## GENERAL INFORMATION

Radio Set AN/TRC-97B is a transportable (FM) radio terminal capable of line-of-sight, tropospheric scatter, and diffraction (obstacle gain) propagation path. The Voice Multiplexer AN/GCC-6 provides 24 voice frequency channels. The Teletype Multiplexer, part of the AN/TRC-97, combines up to 16 TTY channels and applies them to one of the Multiplex AN/GCC-6 voice channels. Radio Set AN/TRC-97B is mounted in Shelter S-308A/TRC-97 which mounts on a standard 3/4-ton cargo Truck M37B1. The major components of the AN/TRC-97B are:

1 each Transmitter T-943/TRC-97

1 each Power Amplifier (1 kw) AM-3972/TRC-97

2 each Receivers R-1245/TRC-97 (two receivers in one cabinet)

1 each Multiplexer AN/GCC-6

1 each Teletype Multiplexer

## TECHNICAL CHARACTERISTICS

Frequency range: 4.4-5.0 GHz (1,200 RF chan w/500 kHz spacing).

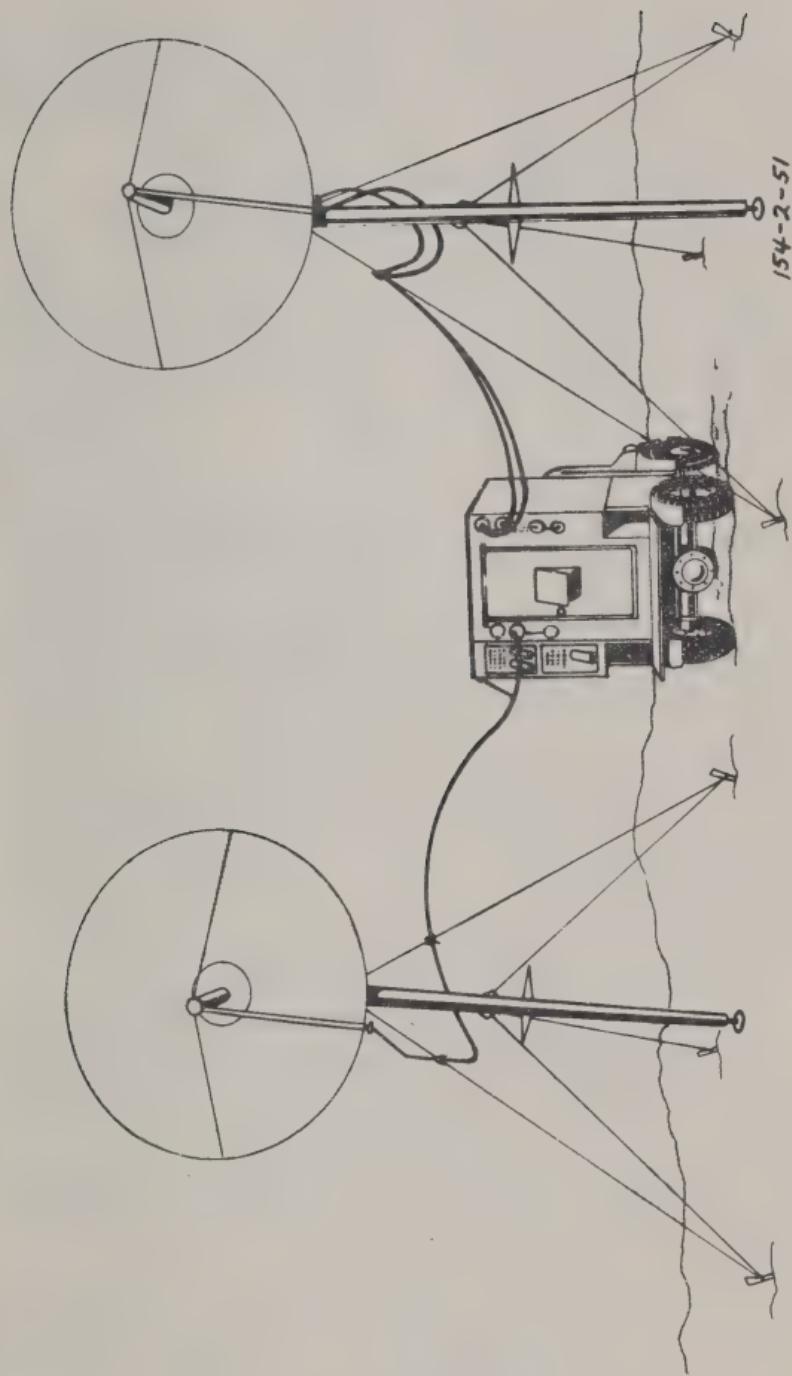
Input devices: AN/GCC-6 (12 to 108 kHz) FDM  
24 voice channels or  
23 voice plus 16 TTY

Transmitter power (w): 1 w, to 1,000 w.

Planning range: 100 miles (tropo).

Antenna: Antenna Group A-7160/TRC-97 is a horn-fed, 8 foot parabolic reflector with a gain of 38 db. Antenna height above ground is 15 feet.

Power req: 120/208 v ac, 3 phase, 400 Hz, 5 kw.



A1 /TRC-97B

RADIO SET AN/GRC-143 AND RADIO  
TERMINAL SETS AN/TRC-112 AND  
AN/TRC-121

STATUS: STD-A; FSN: 5820-926-7355 (GRC-143)  
5820-168-1561 (TRC-112)  
5820-168-1562 (TRC-121)

REF: TM 11-5820-595-12 (GRC-143)  
TM 11-5805-556-15 (TRC-112)  
TM 11-5805-602-15 (TRC-121)

GENERAL INFORMATION

The AN/GRC-143 is a tactical FM tropospheric scatter radio set for communications over distances up to 100 miles. The AN/TRC-112 and AN/TRC-121 are single terminal and dual terminal configurations, respectively, of the AN/GRC-143. The AN/GRC-143 furnishes one kilowatt to the antenna and uses space diversity reception for received signals. The order-wire assembly is located in the bottom of the main transmitter cabinet. Externally multiplexed PCM cable traffic of 12/24 channels and order-wire are applied to transmitter T-961 for transmission over tropo-scatter radio systems. The AN/GRC-143 is solid state except for the 4-cavity, forced air cooled klystron tube. Major components of the AN/GRC-143 are:

- 1 each Transmitter, Radio T-961/GRC
- 1 each Receiver, Radio R-1287/GRC
- 1 each Amplifier, RF AM-6090/GRC (1 kw).

TECHNICAL CHARACTERISTICS

Frequency range: 4.4 to 5.0 GHz (6001 RF chan w/100 kHz sep).

Input devices: 12/24 PCM, TDM channels and order wire. Xmtr power: 1,000 w.

Planning range 100 miles.

Antenna: 10 ft segmented parabolic antennas, with 15 ft sectioned, guyed masts, flexible waveguide feed lines. (Two for AN/TRC-112, Four for AN/TRC-121)

Power req: 115/230 v ac, 47 to 63 Hz, single phase, 3 wire, 5.4 kw

**Configurations:**

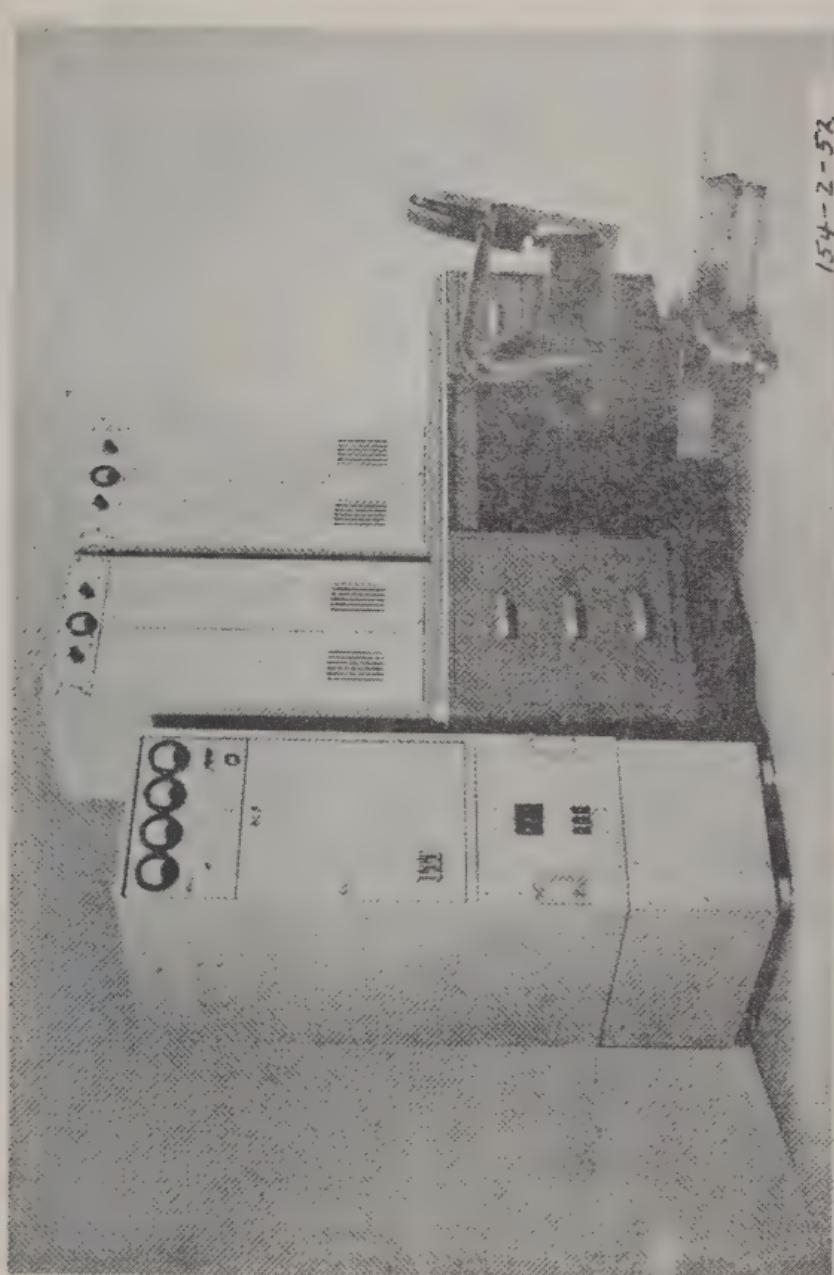
AN/TRC-112 (single terminal, 24 chan), 2 each  
1-1/4-ton vehicles.

AN/TRC-121 (dual terminal, two 24 chan),  
2 each 2-1/2-ton vehicles.

Note: For a complete system, the AN/TRC-112 and AN/TRC-121 must be used with Telephone Terminal AN/TCC-60/69 or AN/TCC-61 which house the PCM multiplex equipment. Radio Set AN/GRC-106 is a component of the AN/TRC-112 and AN/TRC-121 for establishing initial communications.



154-2-52



**AN/GRC-143**

## TOWER AB-216/U

STATUS: STD-A; FSN: 5450-542-4561  
REF: TM 11-5073

### GENERAL INFORMATION

The AB-216/U is a sectionalized and guyed rectangular tower, designed for quick assembly and disassembly, and used to support transmitting and receiving antennas and related equipment. The AB-216/U includes guys, guy anchors, ground rods, light supports, antenna supports (antennas not included), tools and accessories required for the installation of the tower, and associated equipment. A 204-foot tower will support 4 parabolic dish antennas, and can be used for other VHF or microwave antennas. A properly balanced tower will withstand 100 mph winds. The tower can also be used with other types of VHF or microwave antennas.

### TECHNICAL CHARACTERISTICS

Height: 78 to 204 feet in 6 ft increments (300 ft using two towers side by side and cross-braced).

Maximum compression load: 48,000 pounds.

Mounting: Four Tower Support Base Plates AB-206/U.

Sections: Tower Section AB-208/U (1 folding section). Tower Section AB-207/U (12 to 33 folding sections).

Guys: 16 to 36 guys made of nylon-jacketed steel-wire rope.

Anchors: 8 to 16 (main and back) screw or plate anchors.

Note: Basic Tower AB-216/U is 78 feet high. For additional heights, tower section sets, accessory kits, and guy kits must be requisitioned. Daylight marking (orange and white tower sections). Night obstruction marking -- number and type of warning lights and beacons for indication of obstruction to aircraft depend on tower height and must be requisitioned.



154-2-53

AB-216/U

## MULTIPLEXER SET AN/TCC-13

STATUS: STD-A; FSN: 5805-941-0865

REF: TM 11-2141

### GENERAL INFORMATION

The AN/TCC-13 is used with radio equipment such as the AN/TRC-29 to provide twenty-three channels of telephone communication over a single RF channel. The AN/TCC-13 is a component of Radio Terminal Set AN/TRC-38. Two AN/TCC-13 terminals at each end of a system can be used for 45 simultaneous telephone channels over a single RF channel. The AN/TCC-13 will provide long distance quality circuits for telephone, teletype-writer, facsimile and data transmission. The major components of the AN/TCC-13 are:

1 ea Test Equipment Rack (900 lbs) which includes:

- 1 ea Oscilloscope OS-25/G
- 1 ea Audio Test Set TS-762/TC
- 1 ea Control Monitor C-1151/TC
- 1 ea Accessories Case CY-1334/G
- 1 ea Power Supply PP-691/G

1 ea Multiplexer Rack (900 lbs) which includes:

- 1 ea Multiplexer TD-60/TCC-13
- 24 ea Telephone Modem MD-179/TC
- 1 ea Multiplexer Subassembly  
MX-1442/TCC-13
- 1 ea Voltage Regulator CN-236/G (290 lbs)
- 1 ea Switch Box SA-357/G.

### TECHNICAL CHARACTERISTICS

No. of chans: 23 VF (one sys) or 45VF (master w/slave)

Type of modulation: Pulse position (ppm).

Total transmission bandwidth: 1 mHz.

Line side operation: 4-wire at 50 ohms.

Loop side operation: 2- or 4-wire at 600 ohms.

Transmission media: Radio Set AN/TRC-29,  
AN/GRC-67

System range: 600 miles

Chann 1 bandwidth: 300-3,500 Hz

Signaling: 20 Hz.

Loop side operating levels:

Voice input (two-wire): 0 dbm.

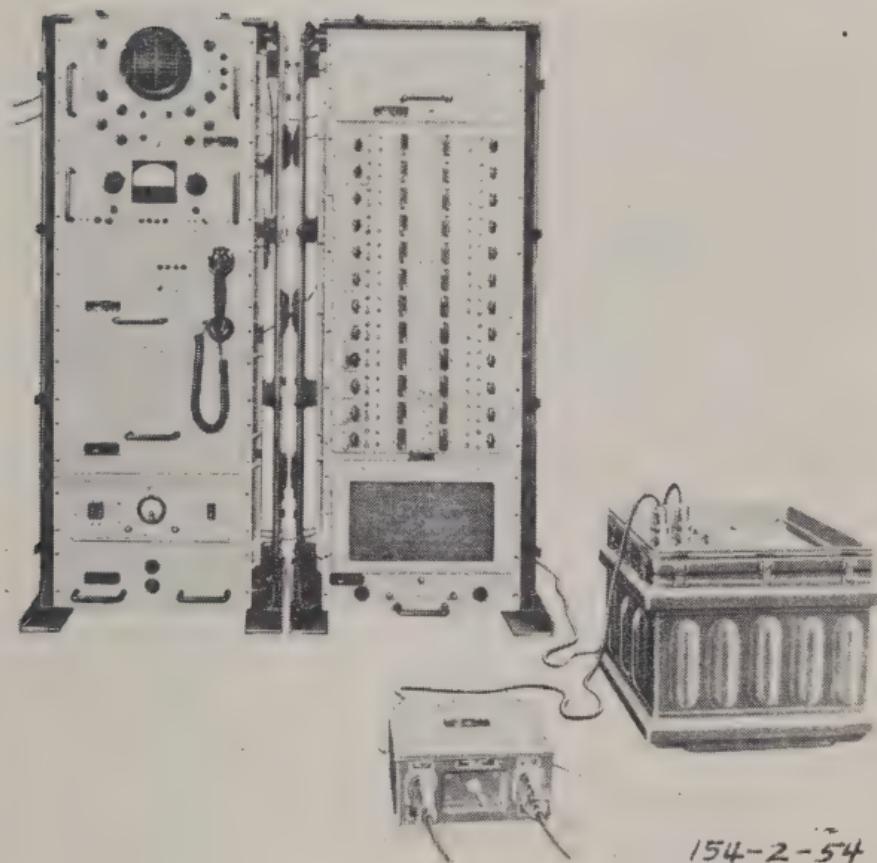
Voice input (four-wire): -4 dbm.

Voice output (two-wire): -3 dbm.

Voice output (four-wire): 0 dbm.

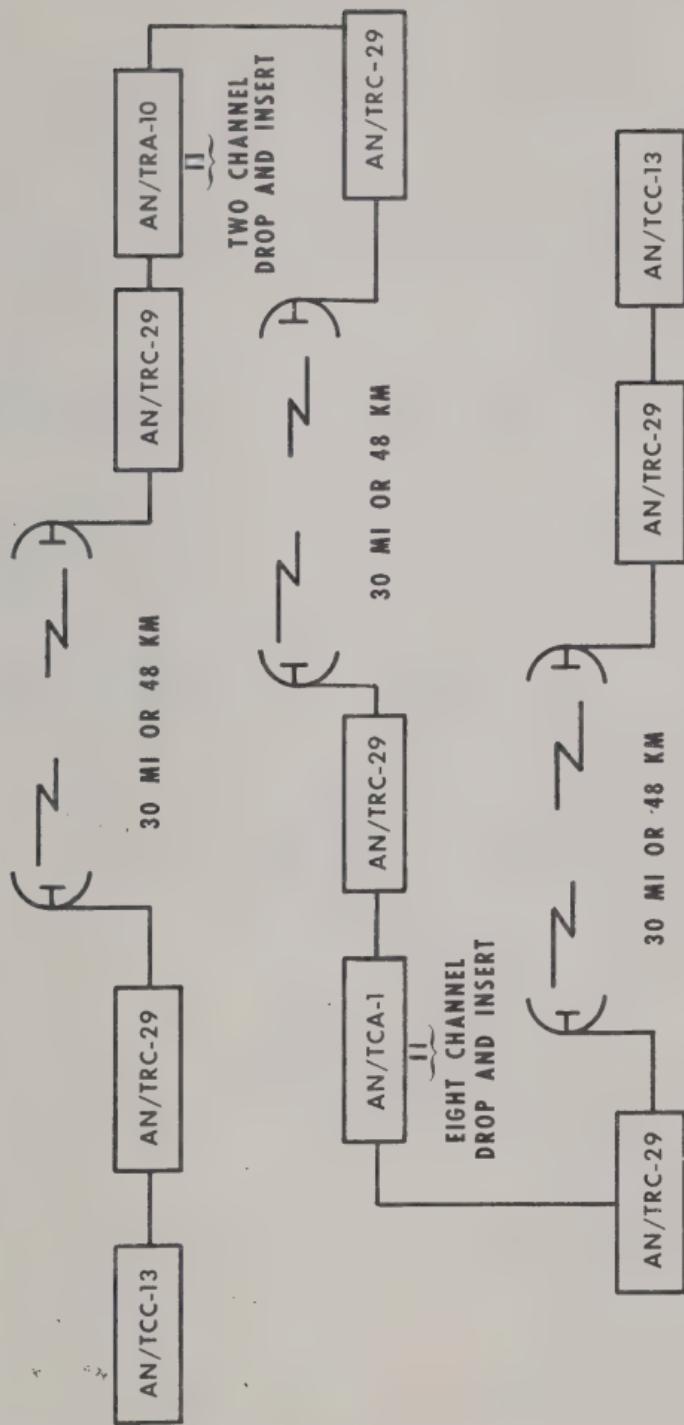
Video transmit level to line: 0.5 volt peak.

Power req: 115/230 v  $\pm$  10%, 47.5 to 63 Hz,  
1,100 w.





TOTAL SYSTEM LENGTH 600 MI OR 965 KM



154-2-57

## MULTIPLEXER GROUP AN/TCA-1

STATUS: STD-A; FSN: 5805-309-3342

REF: TM 11-2141

### GENERAL INFORMATION

The AN/TCA-1 is primarily used as a drop-and-insert terminal at a radio relay link in a multichannel microwave radio-relay communication network. It provides eight independent vf communication channels at a repeater station in a system using AN/TCC-13's and is also used to restore the 23- or 45-channel video pulse train to a standard wave shape. The AN/TCA-1 is a component of Radio Repeater Set AN/TRC-41. Major components of the AN/TCA-1 are:

1 ea Test Equipment Rack (900 lbs) (same components as the AN/TCC-13)

1 ea Multiplexer Rack (880 lbs) which includes:

1 ea Pulse Form Restorer TD-68/G

16 ea Telephone Modem MD-179/TC

1 ea Multiplexer Subassembly MX-1442/TC

1 ea Voltage Regulator CN-236/G (290 lbs)

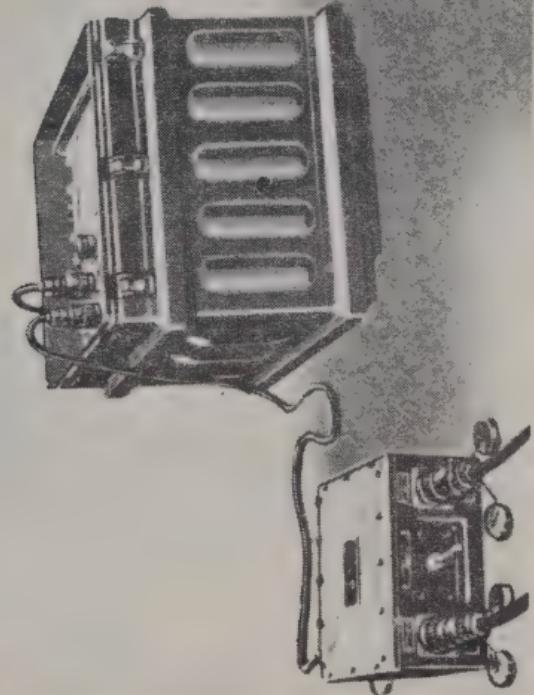
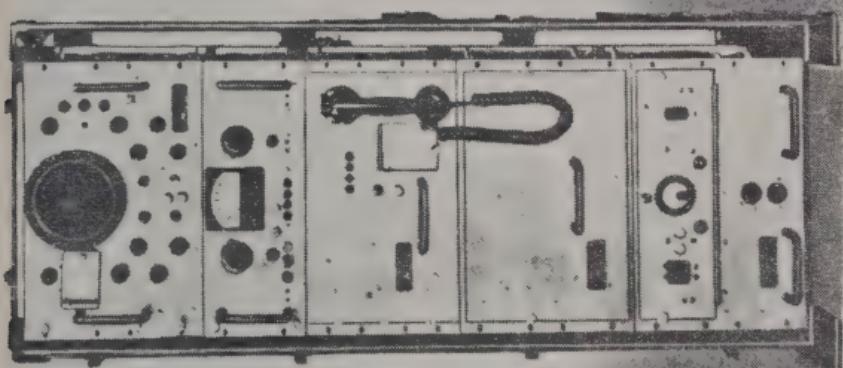
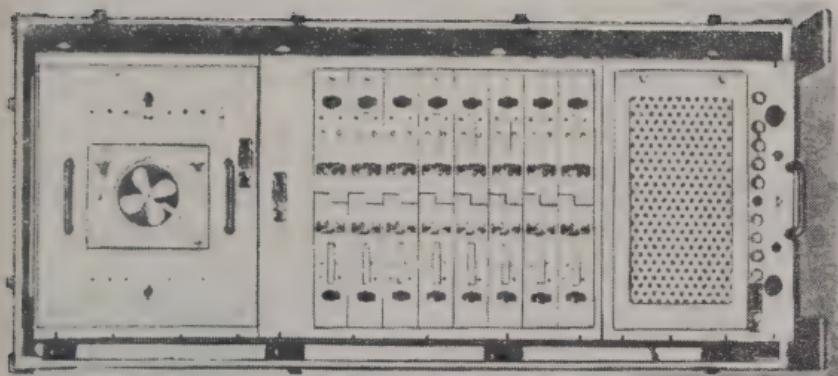
1 ea Switch Box SA-357/G.

### TECHNICAL CHARACTERISTICS

Number of channels: 8 audio in each direction.

Note: All other characteristics are the same as Multiplexer Set AN/TCC-13.

154-2-55



# PULSE FORM RESTORER GROUP AN/TRA-10

STATUS: STD-A; FSN: 5820-538-3816

REF: TM 11-2141

## GENERAL INFORMATION

The AN/TRA-10 is used to reshape a 23- or 45-channel pulse train into a standard wave shape for an AN/TCC-13 system. It also provides two drop-and-insert channels for repeater station communications. The AN/TRA-10 is a component of Radio Repeater Set AN/TRC-40. Major components of the AN/TRA-10 are:

1 ea Equipment Rack (960 lbs) which includes:

1 ea Oscilloscope OS-25/G

1 ea Pulse Form Restorer TD-68/G

4 ea Telephone Modem MD-179/TC

1 ea Power Supply PP-691/G

1 ea Voltage Regulator CN-236/G (290 lbs)

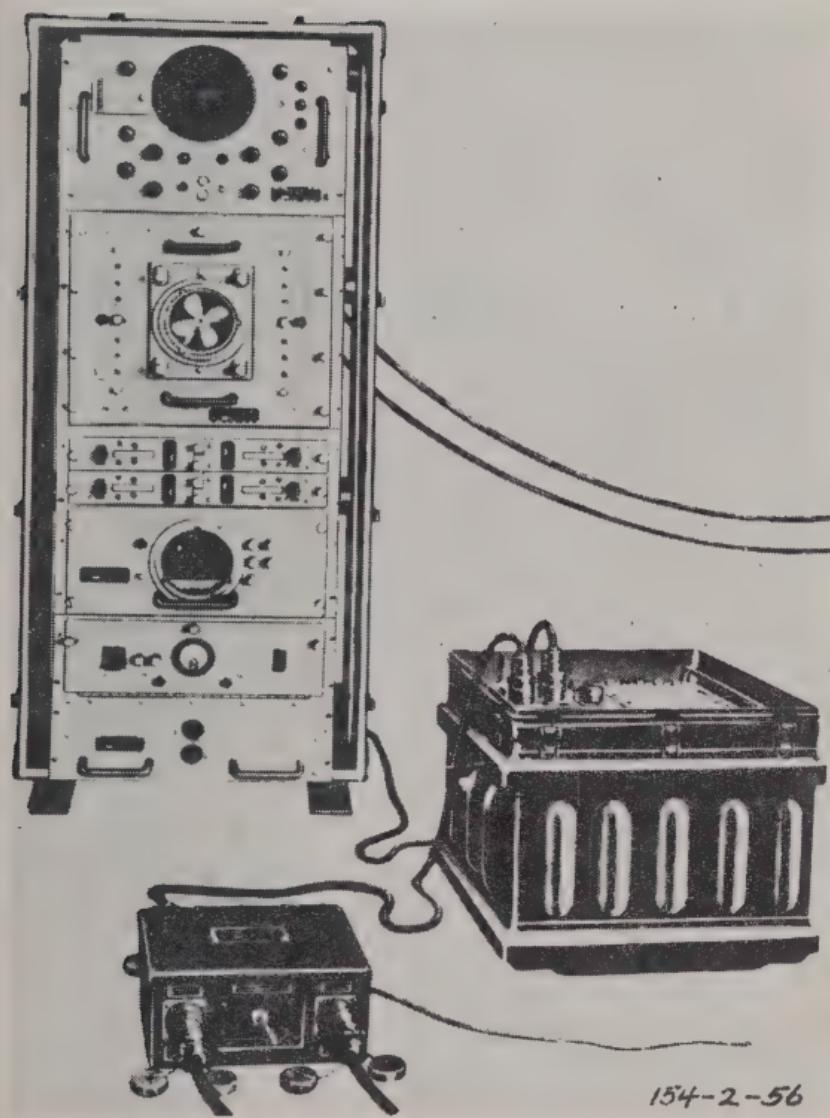
1 ea Switch Box SA-357/G.

## TECHNICAL CHARACTERISTICS

Number of channels: 2 audio in each direction.

Power consumption: 785 watts.

Note: All other characteristics are the same as Multiplexer Set AN/TCC-13.



154-2-56



## CHAPTER 6. RADAR SETS

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## RADAR SET AN/MPQ-4(\*)

STATUS: STD-A; FSN: 5840-543-0759

REF: TM 11-5840-208 - series

### GENERAL INFORMATION

Radar Set AN/MPQ-4(\*) is a mobile, intercept-type (nontracking) set designed primarily to locate hostile mortars and secondarily to adjust low velocity artillery fire.

### TECHNICAL CHARACTERISTICS

Range: Maximum - 10,000 meters

Minimum - 170 meters.

Type: Pulse modulated.

Target indications: B scope

Digital representation of  
easting and northing.

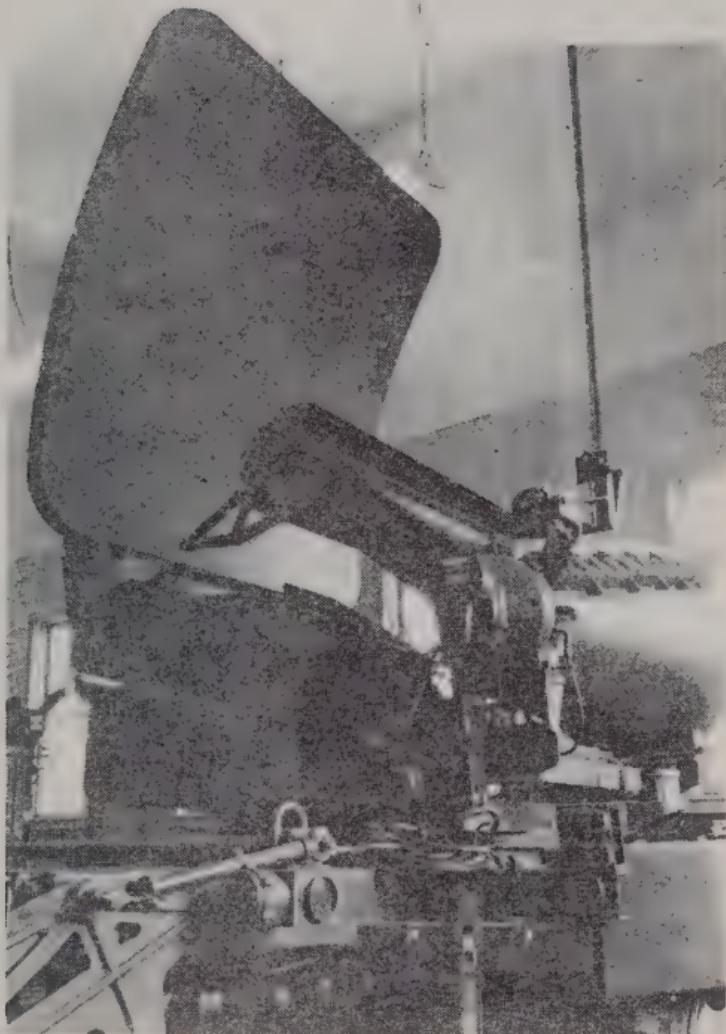
Beam data: Coverage is 445-mil fixed sector  
scanning.

Frequency: 16,000 MHz plus or minus 160 MHz.

Peak power: 50 kilowatt minimum.

Pulse repetition rate: 8,600 pps.

Pulse width: 0.25 microsecond.



# RADAR SET AN/MPQ-10(\*)

STATUS: STD-B; FSN: 5840-378-5006

REF: TM 11-5840-320-25P

## GENERAL INFORMATION

Radar Set AN/MPQ-10(\*) is a lightweight transportable radar set that is designed to locate and track mortar and artillery shells. The set is used with associated recording equipment to locate the point of origin and point of impact of the missile.

## TECHNICAL CHARACTERISTICS

Range: Maximum - 20,000 yards

Minimum - 500 yards.

Type: Pulse modulated.

Target indications: B scope - 0 to 10,000 or 0 to  
20,000 yards

J scope - 2000 yard range.

Beam data: Azimuth and elevation - 5 degrees

Sector scan width - 200 to 800 mils

Azimuthal coverage - 6400 mils  
continuous

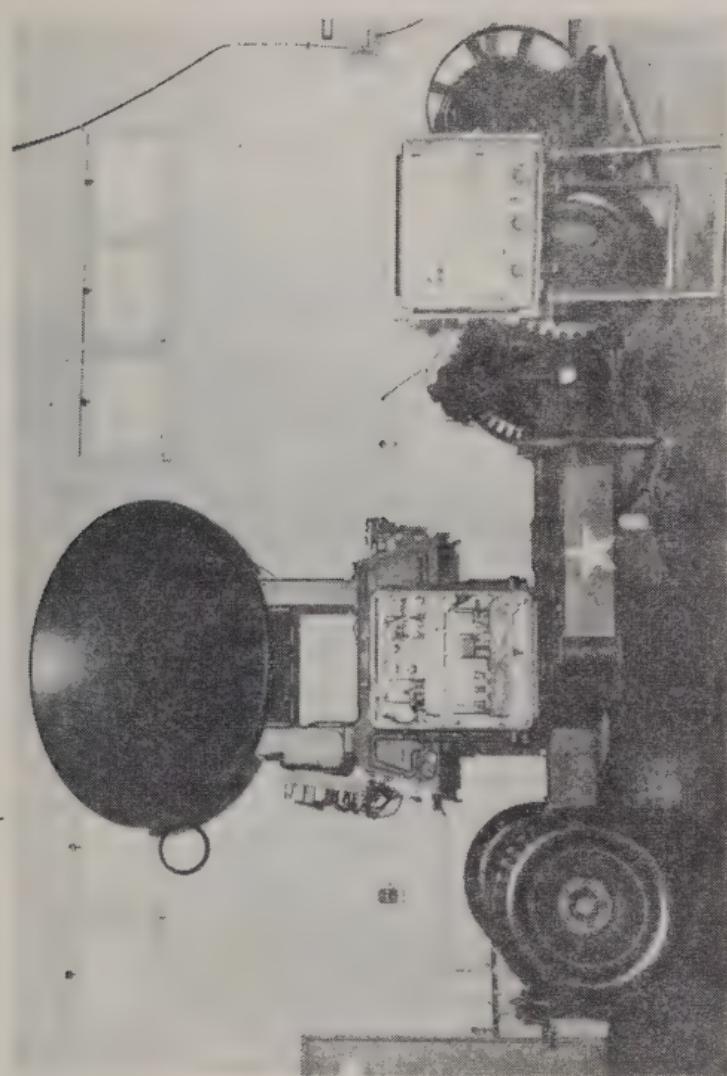
Rotation - 8 rpm maximum.

Frequency: 2740 to 2960 MHz.

Peak power: 200 kilowatts.

Pulse repetition rate: 1,000.

Pulse width: 0.8 microsecond.



## RADAR SET AN/PPS-4(\*)

STATUS: STD-B; FSN: 5840-168-1565

REF: TM 11-5840-211 - series

### GENERAL INFORMATION

Radar Set AN/PPS-4(\*) is a lightweight, man-portable, partially transistorized radar set designed for short range ground surveillance. It uses a 24-volt dc power supply. This set replaced by AN/PPS-5.

### TECHNICAL CHARACTERISTICS

Range: Maximum - 8,000 meters

Minimum - 80 meters.

Type: Noncoherent doppler.

Target indications: Aural - - Headset

Visual - - Deflection on a  
range extension meter.

Beam data: Width - 6.2 degrees

Range gate - 30 meters

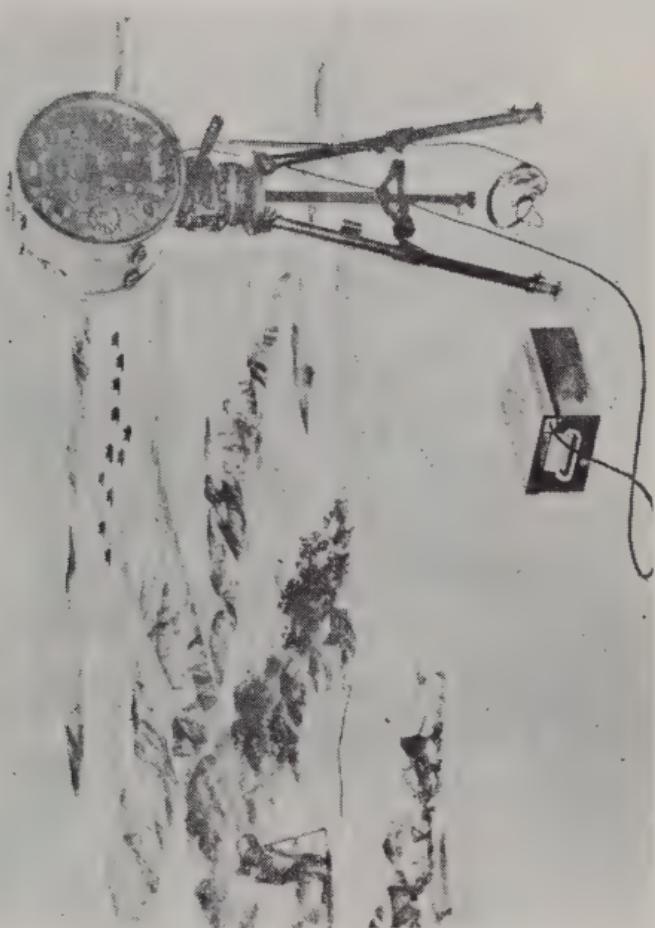
Strobe distance - 500 meters

Frequency: 8,900 to 9,400 MHz.

Peak power: 0.5 kilowatts.

Pulse repetition rate: 5,000 pps.

Pulse width: 0.2 microsecond.



## RADAR SET AN/PPS-5(\*)

STATUS: AN/PPS-5 STD-B FSN 5840-168-1567  
AN/PPS-5A STD-A FSN 5840-238-9366

REF: TM 11-5840-298 - series

### GENERAL INFORMATION

Radar Set AN/PPS-5(\*) is a lightweight man-portable, partially transistorized radar set designed for detection of moving targets at short range.

### TECHNICAL CHARACTERISTICS

Range: Maximum - 10,000 meters for moving vehicles; 6,000 meters for moving personnel

Minimum - 50 meters.

Type: Noncoherent doppler.

Target indications: Aural -- Headset

Visual -- "A" scope for range;  
"B" scope for azimuth.

Beam data: Beamwidth - 20 or 45 mils horizontal  
Vertical beamwidth is 62 mils  
Range gate - 40 meters  
Strobe distance - 600 meters or 5,000 meters.

Frequency: 16,000 to 16,500 MHz.

Peak power: 1.0 kilowatt.

Pulse repetition rate: 4,000 pps.

Pulse width: 0.25 microsecond.



RADAR SET AN/TPN-8(\*) AND CONTROL  
INDICATOR GROUP (AN/TPN-18(\*))

STATUS: STD-A; FSN: 5840-973-2676 (TPN-8)  
LP; FSN: 5840-944-2452 (TPN-18)

REF: TM 11-5840-281 - series

GENERAL INFORMATION

Radar Set AN/TPN-8(\*) is a lightweight, helicopter transportable aircraft traffic control and landing approach radar set designed for use during all weather conditions.

TECHNICAL CHARACTERISTICS

Range: 5, 10, 20 and 40 miles (80 miles for IFF).

Type: Pulse modulated.

Target indications: Beta scan for final approach  
Alpha scan for surveillance.

Beam data: Elevation antenna - 1.1 degree vertical and 3.5 degrees horizontal, vertical or circular polarization.

Azimuth antenna - 3.5 degrees vertical and 1.3 degree horizontal; horizontal or circular polarization.

Frequency: 9,000 to 9,600 MHz.

Peak power: 200 kilowatts.

Pulse repetition rate: 1,200 pps.

Pulse width: 0.2 or 0.8 microsecond.



AN/TPN-8

RADAR SET AN/TPS-1(\*) AND  
AN/FPS-36(\*)

STATIS: AN/TPS-1(\*) STD-A FSN 5840-519-7609  
AN/FPS-36(\*) STD-B FSN 5840-562-8903

REF: TM 11-5840-242 Series

GENERAL INFORMATION

Radar Set AN/TPS-1 is a high-power transportable air search radar set for use in detecting aircraft and other objects at ranges up to 160 nautical miles.

TECHNICAL CHARACTERISTICS

Range: 160 nautical miles. Minimum range is 300 yards.

Type: Pulse modulated with MTI.

Target indications: PPI scope - 20, 40, 80 and 160 nautical miles.

A scope - 20, 40, 80 and 160 nautical miles with an extended 10-mile expanded sweep.

Beam data: Horizontal beamwidth - 3.5 to 4.5 degrees

Vertical beamwidth - 11 to 13 degrees  
Circular scan - 0 to 15 rpm.

Frequency: 1,220 to 1,350 MHz.

Peak power: 575 to 615 kilowatts.

Pulse repetition rate: 360 to 400 pps.

Pulse width: 2.0 microsecond.

Radar Set AN/FPS-36 (TM 11-5840-201 series) is basically an AN/TPS-1 with a range of 200 nautical miles, and a pulse repetition rate of 325 pps. Antenna beamwidth and circular scan rate is also different.



AN/TPS-1

## RADAR SET AN/TPS-25(\*)

STATUS: STD-A; FSN: 5840-082-4128

REF: TM 11-5840-217 - series

### GENERAL INFORMATION

Radar Set AN/TPS-25(\*) is a transportable battlefield surveillance radar set designed to detect the presence of moving targets and to supply information as to their location.

### TECHNICAL CHARACTERISTICS

Range: Maximum - 18,280 meters for moving vehicles

- 4,500 meters for moving personnel

Minimum - 450 meters.

Type: Noncoherent doppler.

Target indications: Aural -- Headset and/or speaker

Visual -- Counter indicators, plotting board and A scope.

Beam data: Horizontal beamwidth - 10 degrees in search, 2 degrees in track

Vertical beamwidth - 4 degrees

Range gate - 75 meters

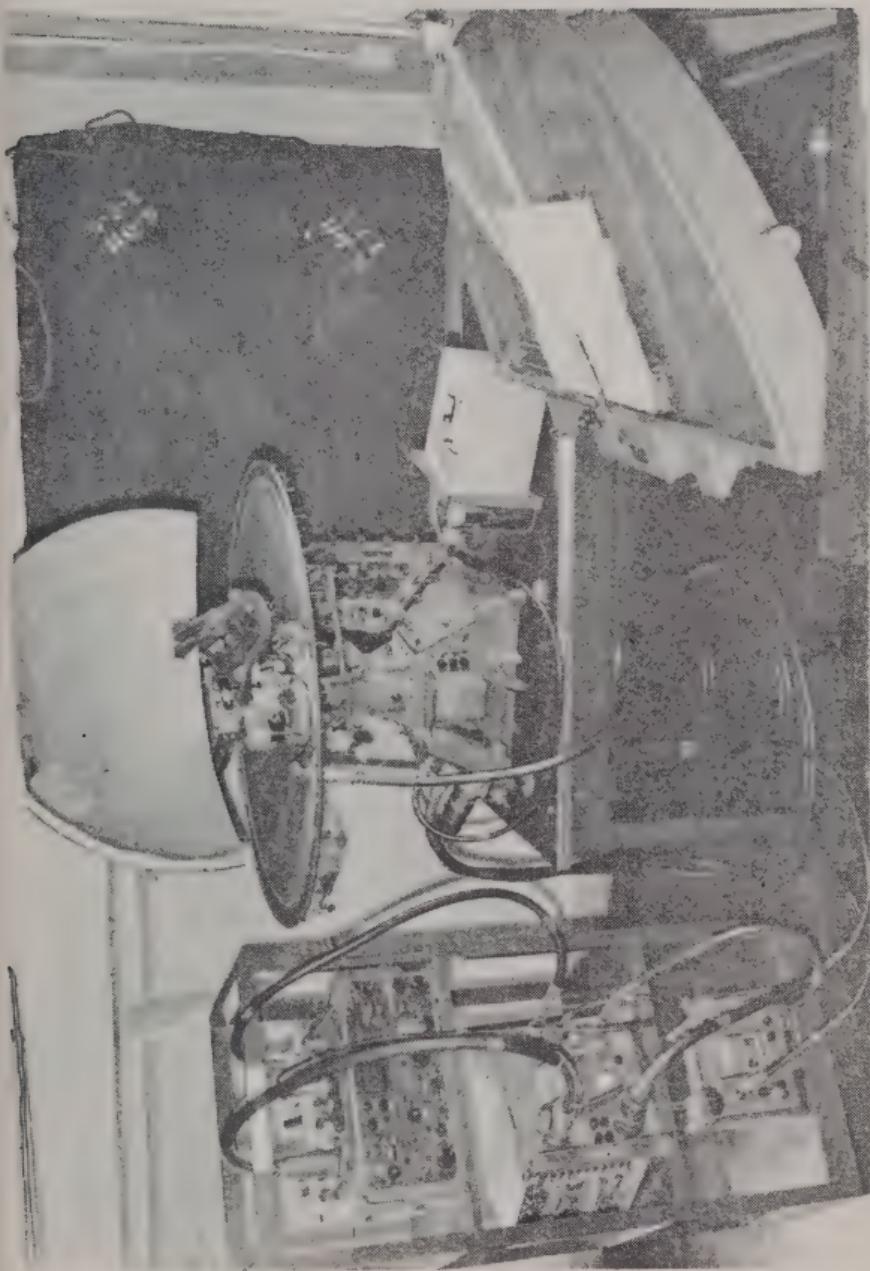
Strobe distance - 900 meters.

Frequency: 9,375 MHz plus or minus 30 MHz.

Peak power: 43 kilowatts.

Pulse repetition rate: 1,850 pps.

Pulse width: 0.5 microsecond.



## RADAR SET AN/TPS-33(\*)

STATUS: STD-B; FSN: 5840-082-4079

REF: TM 11-5840-229 - series

### GENERAL INFORMATION

Radar Set AN/TPS-33 is a lightweight, transportable battlefield surveillance equipment designed to search for and detect moving targets in any direction. Replaced by AN/PPS-5.

### TECHNICAL CHARACTERISTICS

Range: Maximum - 18,280 meters

Minimum - 91 meters.

Type: Noncoherent doppler.

Target indications: Visual -- A scope

Aural -- Headset.

Beam data: Beamwidth - 3 by 10 degrees

Polarization - vertical or horizontal

Sector scan - 600 to 2,200 mils  
(selectable)

Range gate - 91 meters

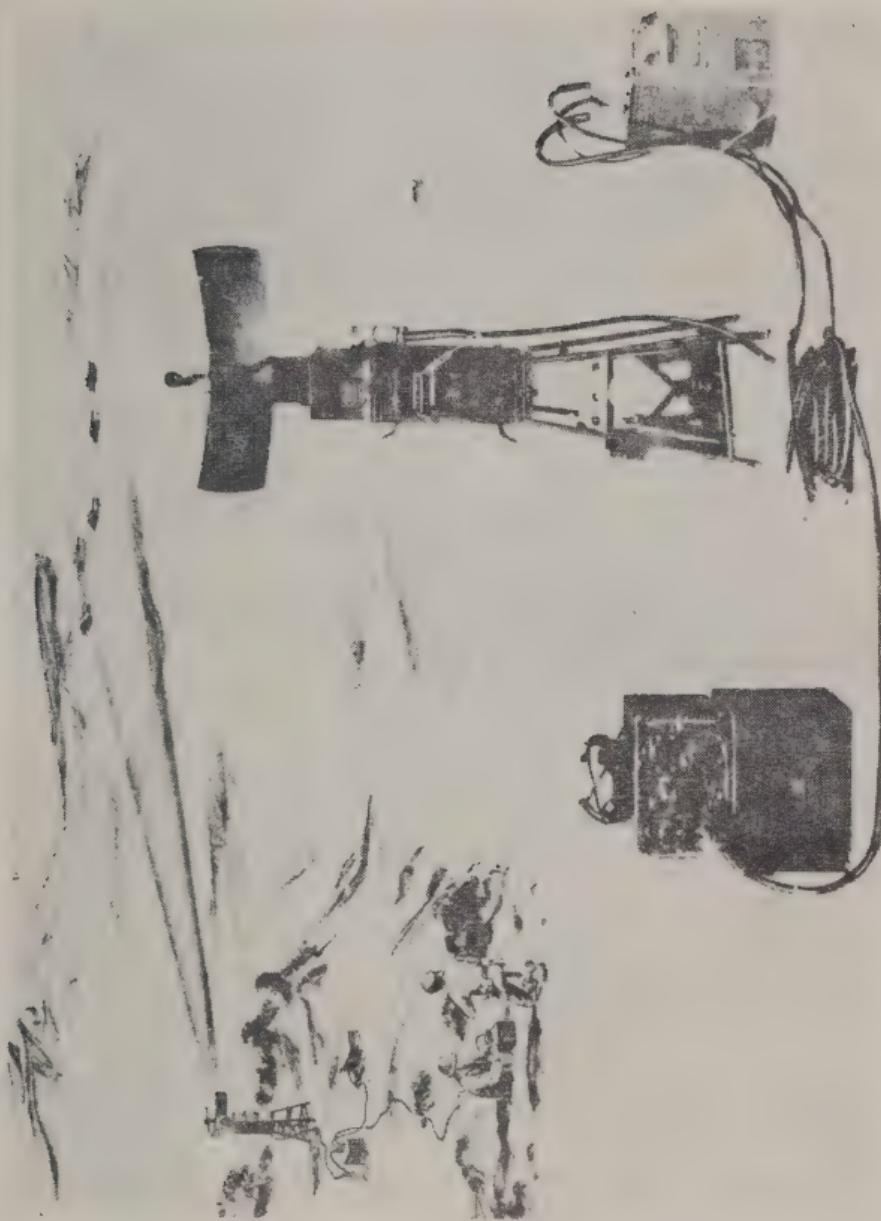
Strobe distance - 804 meters.

Frequency: 9,375 MHz plus or minus 30 MHz.

Peak power: 4 to 7 kilowatts.

Pulse repetition rate: 1,600 pps.

Pulse width: 0.4 microsecond.





## CHAPTER 7. RADIAC EQUIPMENT

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Note: Special instrumental methods, based on the interaction of alpha, beta, gamma, and x-ray radiations with matter, have been developed for the detection and measurements of various nuclear radiations. The radiation detection equipments listed herein, are currently employed by division, corps, and field army units.

### RADIACMETER IM-93A/UD

STATUS: STD-A; FSN: 6665-752-7759

REF: TM 11-6665-214-10

#### GENERAL INFORMATION

A rugged hermetically sealed instrument that is clipped to the clothing of persons exposed to high intensities of radiation, such as those encountered in nuclear weapon fallout fields. The meter detects and measures radiation and indicates the accumulated amount to which the wearer has been exposed. The IM-93/UD is used for the protection of personnel in tactical situations during nuclear warfare.

#### TECHNICAL CHARACTERISTICS

Detector type: Quartz fiber electroscope.

Radiations detected: Gamma and x-rays.

Dosage range: 0 to 600 RAD.

Indicator type: Self-reading quartz-fiber electroscope.

Requirements: External charger such as PP-1578/PD.

## RADIACMETER IM-174A/PD

STATUS: STD-A; FSN: 6665-999-5145

REF: TM 11-6665-232-12

### GENERAL INFORMATION

A portable tactical survey instrument designed to measure gamma radiation dose rates from 1 to 500 RAD/hr. It is used by radiological personnel to determine gamma radiation dose rates from radioactive contaminants.

### TECHNICAL CHARACTERISTICS

Detector type: Unsaturated ionization chamber.

Radiations detected: Gamma rays.

Dosage range: 1-500 RAD.

Indicator type: Panel meter with a simple logarithmic scale reading from 1 to 500 RAD/hr.

Requirements: 2 Batteries BA-1006/U.

2 Batteries BA-1391/U.

2 Batteries BA-1396/U.

RADIOGRAPHIC FILM EXPOSURE HOLDER  
MX-2255/PD

STATUS: STD-A; FSN: 6625-822-3300

REF:

GENERAL INFORMATION

A film badge holder that is clipped to the clothing of wearers exposed to radiation. It detects and indicates the dosage of gamma and x-rays to which personnel have been exposed. Issued by depots to using activities and are returned after use to be processed, read, and reported. A permanent record is maintained by the issuing service.

TECHNICAL CHARACTERISTICS

Detector type: Photographic film.

Radiations detected: Gamma and x-rays.

Dosage range: 2 mRAD to 2,000 RAD.

Note: The MX-2255/PD is issued and read by Lexington Signal Depot.

# RADIAC SET AN/PDR-27J

STATUS: STD-A; FSN: 6665-580-1188

REF: TM 11-6665-209-15

## GENERAL INFORMATION

A watertight, battery-operated, harness or hand-carried instrument that furnishes visual and audible indication, detection, and computation of radioactivity data.

The set detects and measures the rate of received beta and gamma radiation together or gamma radiation alone. Monitoring personnel use this equipment on personnel, objects, or areas for contamination of low intensities.

## TECHNICAL CHARACTERISTICS

Detector type: Geiger-Muller (GM) tube.

Radiations detected: Beta, gamma, and x-rays.

Sensitivity range: 0 to .5 RAD/hr.

0 to 5 RAD/hr.

0 to 50 RAD/hr.

0 to 500 RAD/hr.

Indicator type: Visual: In RAD/hr on four linear color-coded scales.

Aural: By headset, audio jack.

Requirements: Battery, see TM on particular model.

# RADIAC SET AN/PDR-60

STATUS: STD-A; FSN: 6665-965-1516

REF: TM 11-6665-221-15

## GENERAL INFORMATION

A battery operated portable alpha and gamma detecting and measuring instrument.

The maximum distance range of alpha particles depends upon their energy. Under standard conditions, the maximum range of alpha particles from PU-239 is 1.4 inches. The maximum range of alpha particles from U-238 is 1.06 inches. Because of their large mass, alpha particles travel in a straight line.

## TECHNICAL CHARACTERISTICS

### Detector types:

Alpha monitoring: Scintillation type detector which is cable-connected to the instrument.

Gamma monitoring: Geiger - Muller Detector.

### Dosage ranges:

Alpha: 0.2000 Counts per minute.

0-20,000 Counts per minute.

0-200,000 Counts per minute.

0-2,000,000 Counts per minute.

Gamma: 0-2 RAD/hr.

### Indicator type:

Visual: Meter mounted on panel.

Aural: By headset.

Requirement: Battery (see TM on equipment).

Note: Counts per minute is the number (or count) of alpha particles that penetrate the face of a probe, indicating the rate of alpha particle emission from a radio active element.

# RADIAC DETECTOR CHARGER PP-1578/PD

STATUS: STD-A; FSN: 6665-542-1177

REF: TB 11-6665-215, 216

## GENERAL INFORMATION

A hand-carried portable instrument that charges a radiac detector by means of electrostatic friction. Static voltage for the radiac-meter is provided merely by turning the plastic rotor with the fingers.

The unit requires no batteries, but it does need an external natural or artificial light source for reading during the charging process.

The PP-1578/PD is used to charge US dosimeters, such as Radiacmeters IM-9/PD, IM-93/PD, and IM-147/PD. With an adapter it can also charge all United Kingdom dosimeters.

## TECHNICAL CHARACTERISTICS

Charging voltage output: 0 to 220 v.

Power requirements: Electrostatic friction charger.



## CHAPTER 8

### SATELLITE COMMUNICATIONS

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## COMMUNICATION SATELLITE INTRODUCTION

Communications satellites employ a transponder which receives, amplifies, and retransmits communications signals. Frequencies in the band allocated for space communications are received and amplified without altering their modulation. Signal amplification occurs at radio frequencies through a traveling wave tube and, after being down-converted, are retransmitted at the lower frequencies within the space communication band down to the ground terminals.

Certain characteristic information about the operating capability of the satellite may be transmitted to earth in the standard telemetry band whenever sufficient power is available from the satellite solar cells.

In the Phase I satellites, a beacon signal is continuously transmitted and is used by a ground terminal to determine when its antenna is pointed at a satellite. A "signature" frequency is employed to modulate the beacon and serves to identify an individual satellite.

The Phase I satellites used by the Defense Satellite Communications System (DSCS), employ a transponder which has a bandwidth of approximately 50 MHz. Since solar cells provide the only power, approximately 2.5 watts (37 dbm) of effective radiated power is available to support communications. There is no command function and therefore no external control over the satellite once it has been injected into orbit.

The new Phase II satellites have an expanded bandwidth of 500 MHz, and are synchronous. Ground control of the antenna systems is possible, and the satellites can be moved into new orbits. In addition, there are both Narrow Beam (NB) and Earth Coverage (EC) antennas, and the NB antennas are steerable by ground command. Cross mode operation is possible by choosing correct frequencies.

Future military communications satellites will function similarly to the present satellites, but will have significantly greater communications capability as well as a command and control function to enable tailoring of the operating characteristics of the satellite from the ground. The Tactical Communications Satellite (TACSAT I) used with the Tactical Satellite Communications Equipment is the forerunner of such satellites.

The Phase I, Phase II and TACSAT I satellites employ different frequency shifting and different operational frequencies, as shown in the following tables. In the phase I satellites, there is a SHF Beacon (7300 MHz) and UHF Beacon (about 400 MHz) where Phase II uses 7250.1 and 7675.1 MHz. TACSAT I also employs dual beacons of 7298.5 MHz and 254.1 MHz.

# RADIO TERMINAL, SATELLITE COMMUNICATIONS AN/TSC-54

STATUS: Limited Production; FSN: 5895-937-4993  
REF: POMM 11-5895-389-12, -34, -50

## GENERAL INFORMATION

The AN/TSC-54 is a radio terminal designed for quick reaction use with a military satellite communications system. It is completely transportable in one C-130 cargo aircraft. The total basic terminal weight is 23,000 pounds and requires only a few hours for assembly, installation, and the initiation of operations. Terminal elements break down into packages, none weighing more than 6,000 pounds, for helicopter airlift.

## TECHNICAL CHARACTERISTICS

Frequency range: Transmit 7.9 to 8.4 GHz  
(select one of four preset chans)  
Receive 7.25 to 7.75 GHz  
(select two of four preset chans)

Type of service: 50,000 F9, single channel voice and teletypewriter.

Baseband: 0 to 23 kHz

Input devices: AN/TCC-29 (voice plus teletypewriter),

AN/URC-61 (up to 1200 BPS)

Special broadband @ 70 MHz.

Transmitter power: 5 kw (maximum) (37 dBw)

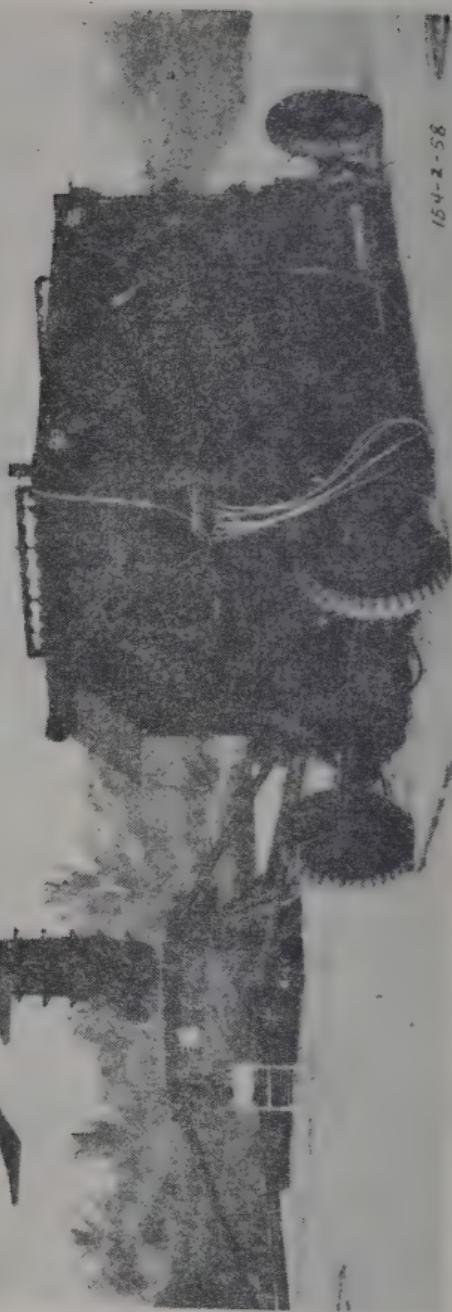
Planning range: Up to 10,000 statute miles

Power required: 45 kw (maximum) @ 120 v, 400 Hz

## SPECIAL FEATURES

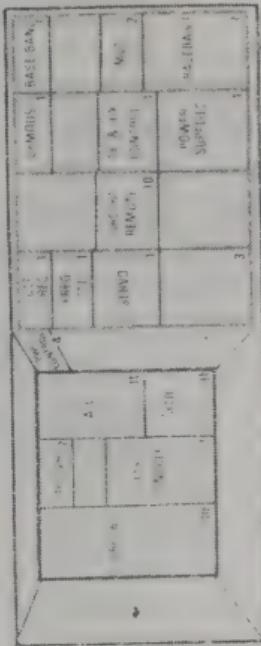
The AN/TSC-54 consists of a "cloverleaf" antenna made up of four individual parabolic surfaces 10 feet in diameter. The remainder of the terminal consists of an operations shelter and one motor generator.

1. Antenna: Solid paraboloid surface, azimuth-elevation mount, dual electric drives, four individual cassegrain feed horns with "Dielguide" system, pseudo-monopulse feed. Realizes a 52db gain.
2. Shelter: Modified S-141/G contains operating consoles for tracking and communications functions as well as electronics for interfacing terminal with standard military communications users.
3. Motor generators: 45-kw Diesel engine driven; one required on line for full capability. A second motor generator is required for backup during extended operation of the terminal.
4. Operating crew: Dependent upon operational applications and varies according to local requirements, number of terminals in operation at the same station, etc. Basic operation of equipment requires three men at any one time.



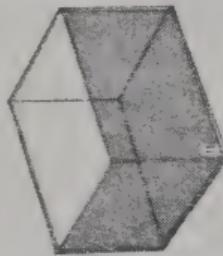
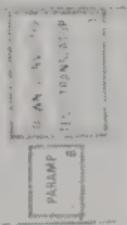
154-2-58

**AN/TSC-54**

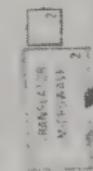
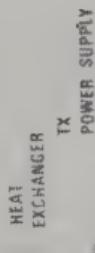


RF BOX

RIGHT  
LEFT



EQUIPMENT SHELTER



154-2-59

AN/TSC-54

# RADIO TERMINAL, SATELLITE COMMUNICATIONS AN/MSC-46

STATUS: LP; FSN: 5820-999-7317

REF: Manufacturer's Manual

## GENERAL INFORMATION

The AN/MSC-46 is the first radio terminal specifically designed for a military satellite communications system. It is completely air-transportable in three C-133 cargo aircraft. The total basic terminal weight is 125,000 pounds and requires certain site preparation prior to installation and use. The terminal was designed to operate via the Defense Satellite Communications System (DSCS) satellites with a compatible ground terminal to provide from 1 to 12 voice frequency grade channels.

## TECHNICAL CHARACTERISTICS

Frequency range: Transmit 7.9 to 8.4 GHz

(select one of four preset chans)

Receive 7.25 to 7.75 GHz

(select two of four preset chans)

Type of service: 560,000 F9 (max)

Baseband: 20-60 kHz

Input devices: AN/FCC-55 (12-channel FDM),

AN/URC-55 (up to 48000 BPS),

Special broadband @ 70 MHz.

Transmitter power: 10 kw (maximum) (40 dBw)

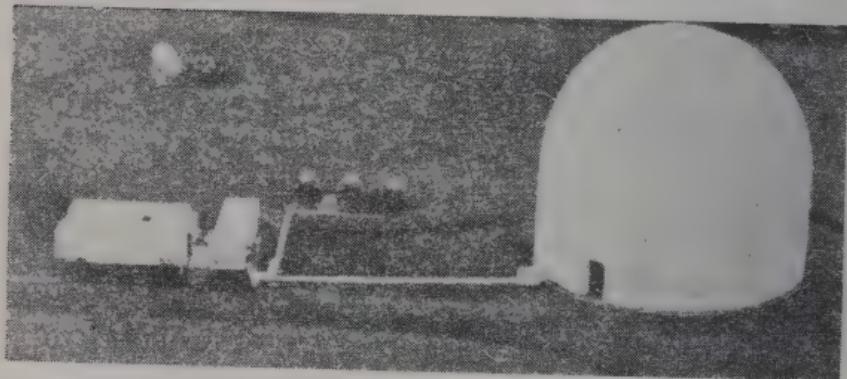
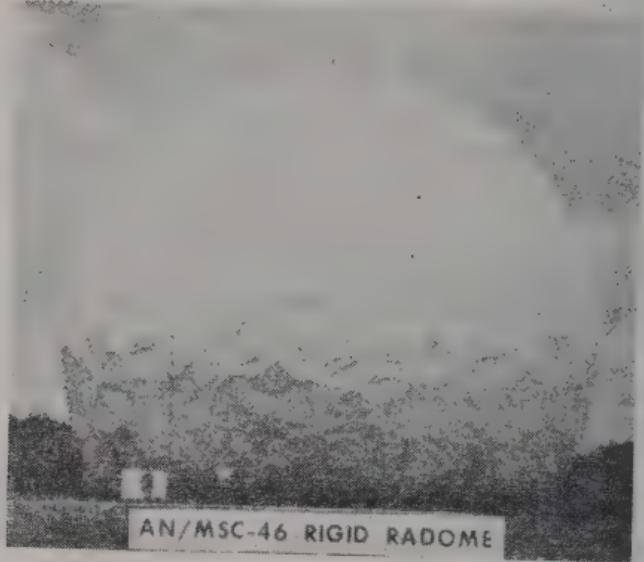
Planning range: Up to 10,000 statute miles

Power required: 175 kw (maximum) @ 120/208 v,  
48 to 52 Hz or 58 to 62 Hz.

## SPECIAL FEATURES

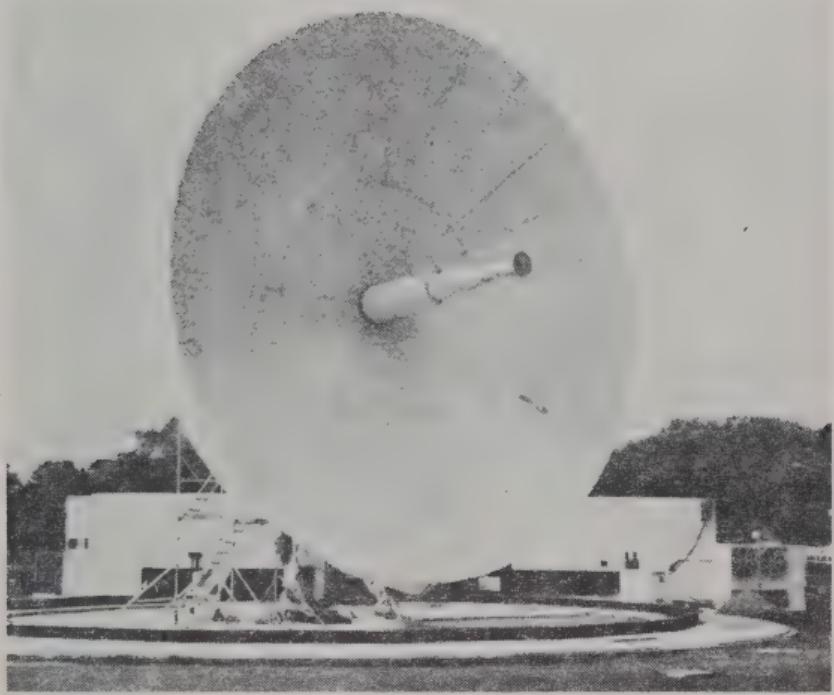
The AN/MSC-46 consists of a parabolic antenna 40 feet in diameter, which is inclosed in either an inflatable or a rigid radome; three transportable vans, 30 feet long; and three motor generators.

1. Antenna: Solid paraboloid surface, azimuth-elevation mount, dual electric drives, four horn simultaneous lobe comparison cassegrain feed system with "Dielguide" modification. Realizes a 62db gain.
2. Vans:  
Operations Control Van (OCV): Control console and most major electronic equipment for communications and satellite tracking functions.  
  
Cargo van: Transport for inflatable radome and antenna reflector surface; after installation the van provides utility space, primary power distribution, and transmitter beam power.  
  
Maintenance van: Spare parts storage and test equipment with space for bench maintenance.
3. Motor generators: Three 100-KVA Diesel engine driven; two required available on-line at any one time for full terminal capability. The third is required for back-up during normal operation of the terminal.
4. Operating crew: Dependent upon operational applications and varies according to local requirements, number of terminals in operation at same station, etc. Basic operations of equipment requires a minimum of three men at any one time.



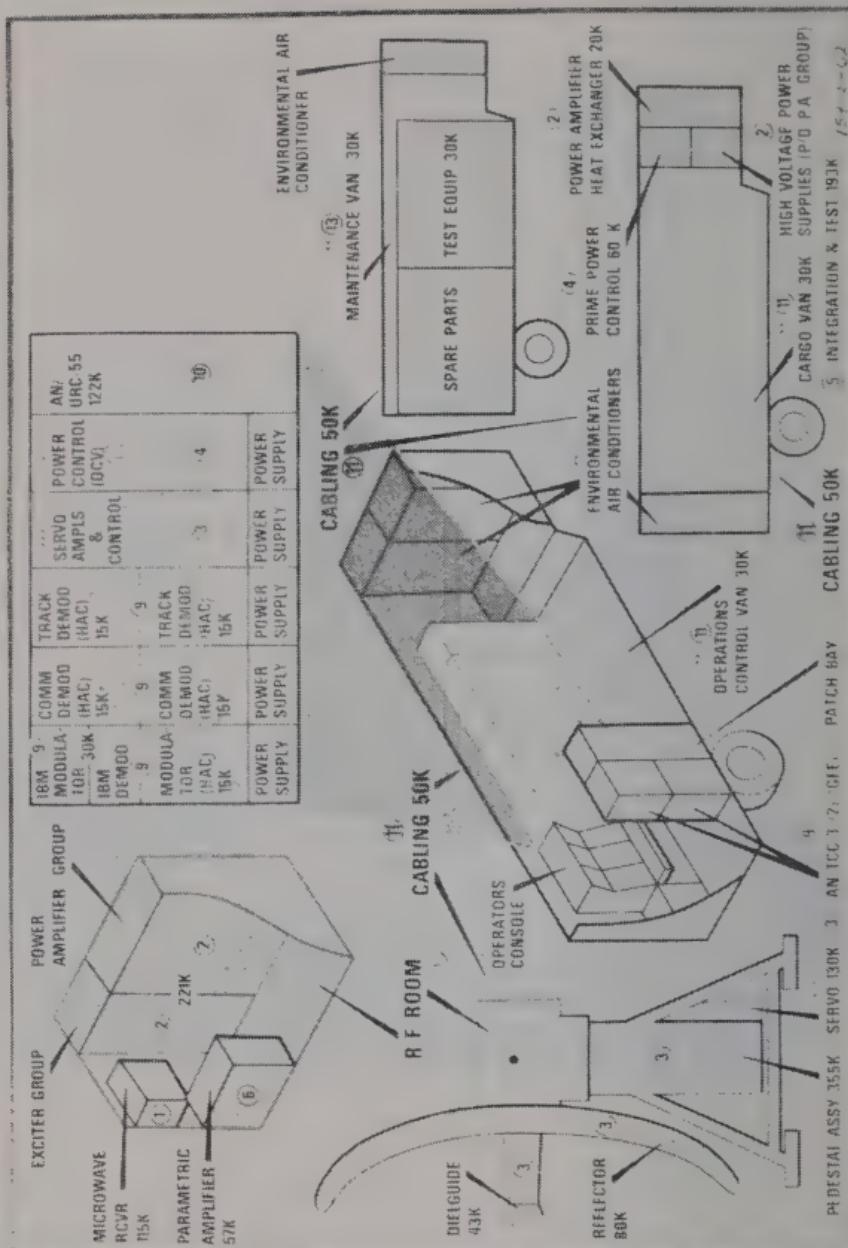
AN/MSC-46 TERMINAL  
w/inflatable Radome

154-2-60



AN/MSC-46 ANTENNA

154-2-61



## RADIO TERMINAL, SATELLITE COMMUNICATIONS AN/FSC-9

STATUS: Developmental FSN:

REF:

### GENERAL INFORMATION

The AN/FSC-9 terminals have been used since the earliest days of military satellite communications. Two of these terminals were built and are located at Fort Dix, New Jersey and Camp Roberts, California. Much of the research leading to development of all present satellite communications systems, commercial or military, was conducted at these two stations. Presently, the AN/FSC-9 terminals are used with the Defense Satellite Communications System (DSCS) and provide radio terminal communications via satellite from either the Pacific Area or Europe into the continental United States.

### TECHNICAL CHARACTERISTICS

Frequency range: Transmit 7.9 to 8.4 GHz  
(select one of four preset chans)  
Receive 7.25 to 7.75 GHz  
(select two of four preset chans)

Type service: 560,000 F9, 12 duplex VF channels  
or 4800 BPS digital traffic.

Baseband: 60 kHz

Input devices: Analog AN/FCC-55, Digital  
AN/URC-55, Special wideband  
@ 70 MHz.

Transmitter power: Up to 20 kw.

Planning range: Up to 9,000 statute miles.

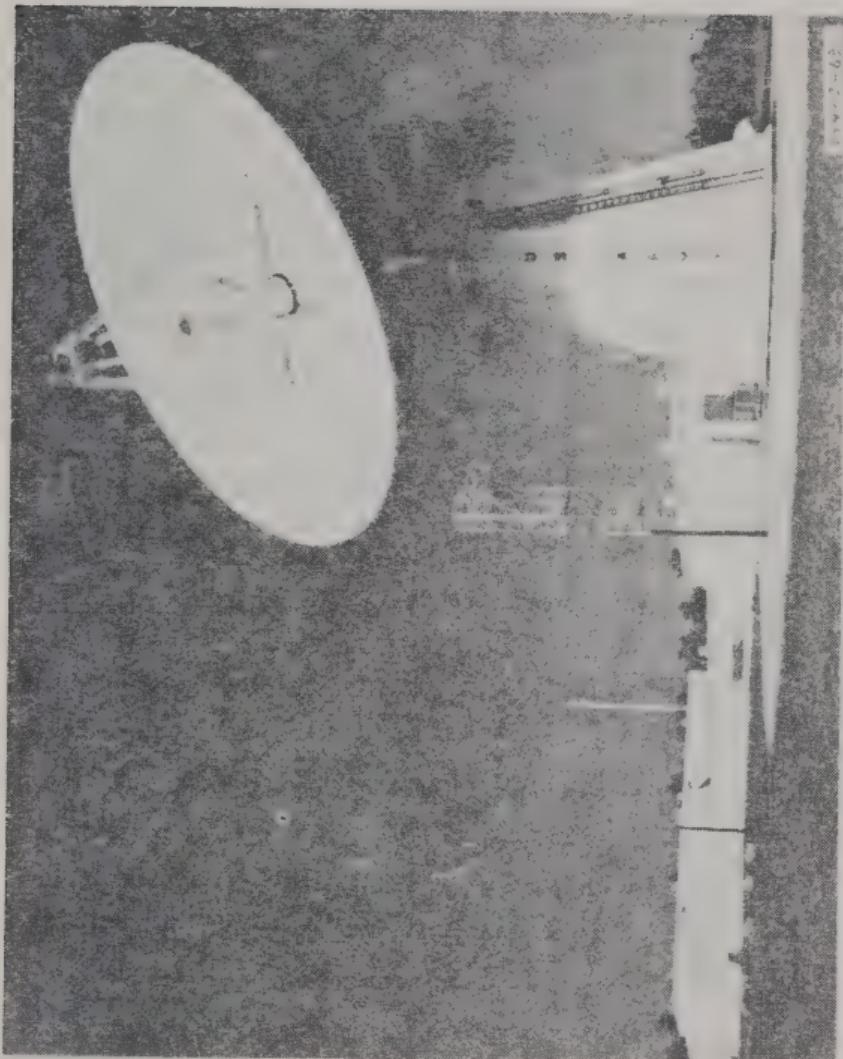
Power required: 115/230 v ac @ 50/60 Hz.

### SPECIAL FEATURES

A complete AN/FSC-9 terminal consists of an antenna, antenna tower, and operations building.

1. Antenna: Paraboloid surface, 60 feet in diameter. Weight 190 tons. Maximum height 80 feet. Cassegrain feed system modified by "Dielguide." Pseudomonopulse conical-scan tracking. Realizes a 59 db gain.
2. Antenna tower: Supports antenna and houses transmitter on a ground floor. Receiver is on second floor and behind antenna reflector surface.
3. Operations building: Houses control room, communications terminal equipment, antenna drive system generators, repair parts storage and maintenance area, and terminal/station office and administrative area.

Operating crew: Minimum of four operators per shift. Terminal/station requirements will include administrative, utility, and maintenance personnel and will vary with the mission of the terminal.



**AN/FSC-9**

RADIO TERMINALS, SATELLITE  
COMMUNICATIONS AN/TRC-157,  
AN/MSC-58, AN/TRC-156, AN/TRR-32  
AN/TSC-80, AN/MSC-57, AN/TSC-79  
AND AN/TRR-30

STATUS: Developmental FSN:

REF:

GENERAL INFORMATION

The Tactical Satellite Communications (TACSATCOM) Program is directed by the Joint Chiefs of Staff. The Army (SATCOM Agency) is the "lead service" for procurement of all SHF tactical terminals. The Air Force (Electronic Systems Division) is the "lead service" for procurement of all UHF tactical terminals.

The surface portion of TACSATCOM involves two families of terminal configurations -- one in the SHF band, the other UHF -- designed for operation with TACSATCOM I, a synchronous SHF/UHF satellite. Both UHF and SHF terminals are similar, built on a concept of modular construction and commonality of basic components. This will guarantee interoperability between terminal types and also permit both separate and joint service tests of the communications facility without the necessity for any one service to provide all the terminals required.

For use by the Army, Navy, Air Force and Marine Corps, both UHF and SHF terminals include six basic configurations: alert receiver, team pack, 1/4-ton jeep, 1-1/4-ton shelter, airborne and shipboard. Communications between SHF and UHF terminals are achieved via the satellite which interconnects the appropriate transponders. Each terminal is capable of simultaneous transmission and reception of one voice or one teletypewriter channel. SHF 1-1/4-ton terminals, however, may provide 6 voice channels.

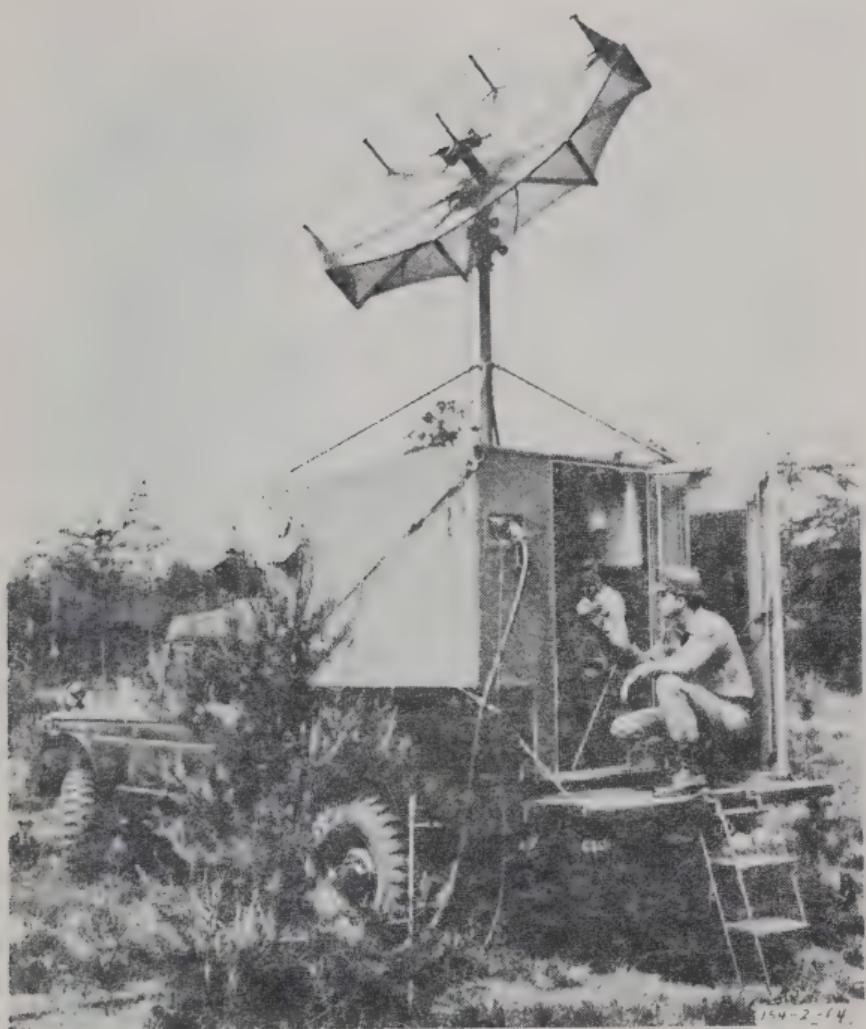
## TECHNICAL CHARACTERISTICS

### Configurations:

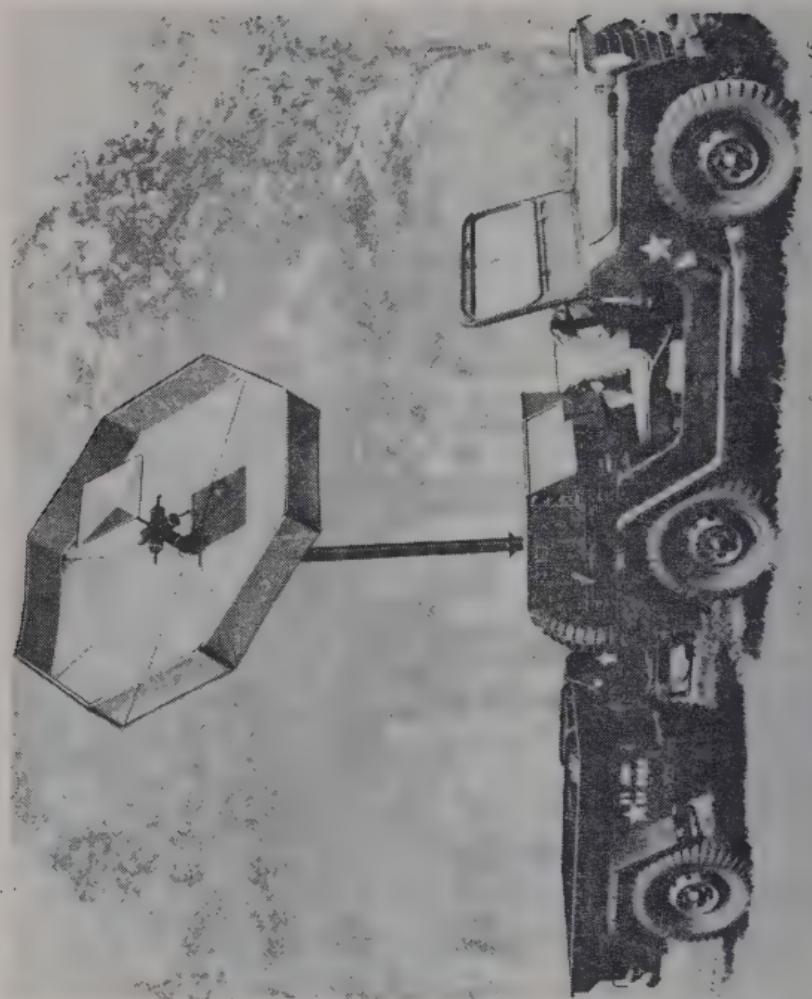
Vehicular:	Set	Vehicle
	AN/TRC-157 (UHF)	1 1/4-ton
	AN/TSC-80 (SHF)	
	AN/MSC-58 (UHF)	1/4-ton
	AN/MSC-57 (SHF)	
Airborne:	AN/ARC-146 (UHF)	Helicopter
	AN/ASC-14 (SHF)	Fixed Wing
Man pack:	AN/TRC-156 (UHF)	Team pack
	AN/TSC-79 (SHF)	(3 men)
	AN/TRR-32 (UHF)	Man pack
		(1 man)
	AN/TRR-30 (SHF)	Man pack
		(1 man)

Tactical Satellite Communication Terminals -- Technical Characteristics

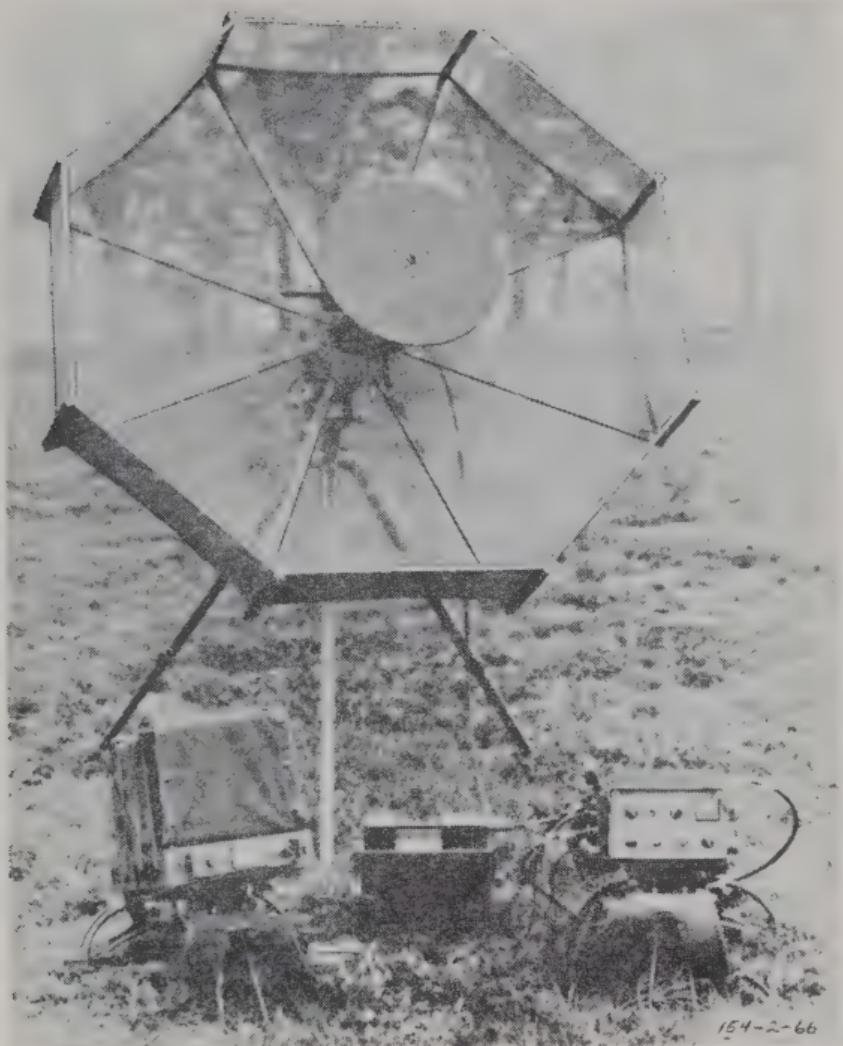
Equipment	Service option	Transmitter power	Power required	Weight
UHF Series (240 to 315 MHz)				
AN/TRC-157 (1 1/4-ton truck)	a. 1 Analog or digital full duplex VF channel b. Alert signal transmit and receive	1 to 500 watts	@ 50/60 Hz	Shelter 1700 pounds Motor generator 850 pounds
AN/MSC-58 (1/4-ton truck)	a. 1 Analog or digital full duplex VF channel b. Alert signal receive	1 to 100 watts	a. 115/220 v ac ac @ 50/60 Hz b. 22-30 v dc	Radio 550 pounds Motor generator 400 pounds
AN/TRC-156 (Team pack)	a. 1 Analog or digital push-to-talk VF channel b. Alert signal receive	2 or 20 watts	20-28 v dc	120 pounds including battery
AN/TRR-32 (Alert receiver)	Alert signal reception	N/A	18-30 v dc	15 pounds including battery
SHF Series (7.25 to 8.0 GHz)				
AN/TSC-80 (1 1/4-ton truck)	a. 6 Analog or digital full duplex VF channels b. Alert signal receive	1.5 to 500 watts	115/220 v ac @ 50/60 Hz	Shelter 1650 pounds Motor generator 1650 pounds
AN/MSC-57 (1/4-ton truck)	a. 1 Analog or digital full duplex VF channel b. Alert signal receive	3 to 100 watts	a. 115/220 v ac @ 50/60 Hz b. 22-30 v dc	Radio 725 pounds Motor generator 650 pounds
AN/TSC-79 (Team pack)	a. 1 Analog or digital push-to-talk VF channel b. Alert signal receive	Up to 3 watts	20-28 v dc	184 pounds including battery
AN/TRR-30 (Alert receiver)	Alert signal reception	N/A	18-30 v dc	62 pounds including battery



RADIO TERMINAL, SATELLITE COMMUNICATIONS (UHF) AN/TRC-157



RADIO TERMINAL, SATELLITE COMMUNICATIONS (UHF) AN/MSC-58

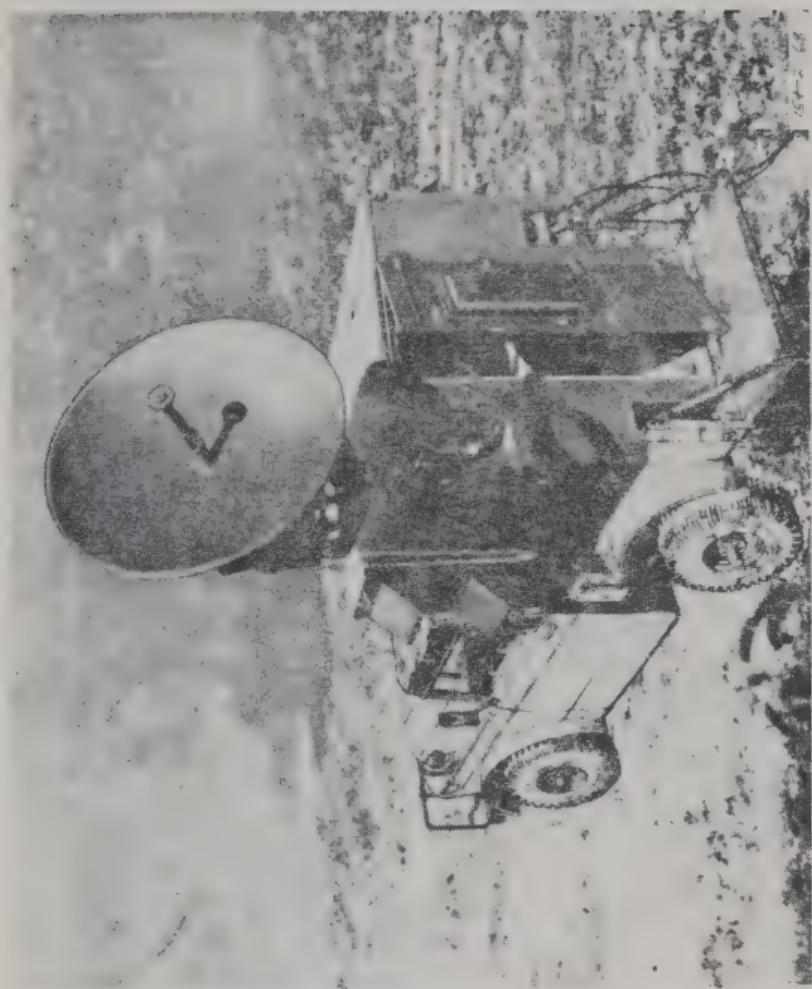


RADIO TERMINAL, SATELLITE COMMUNICATIONS (UHF) AN/TRC-156

154-2-67



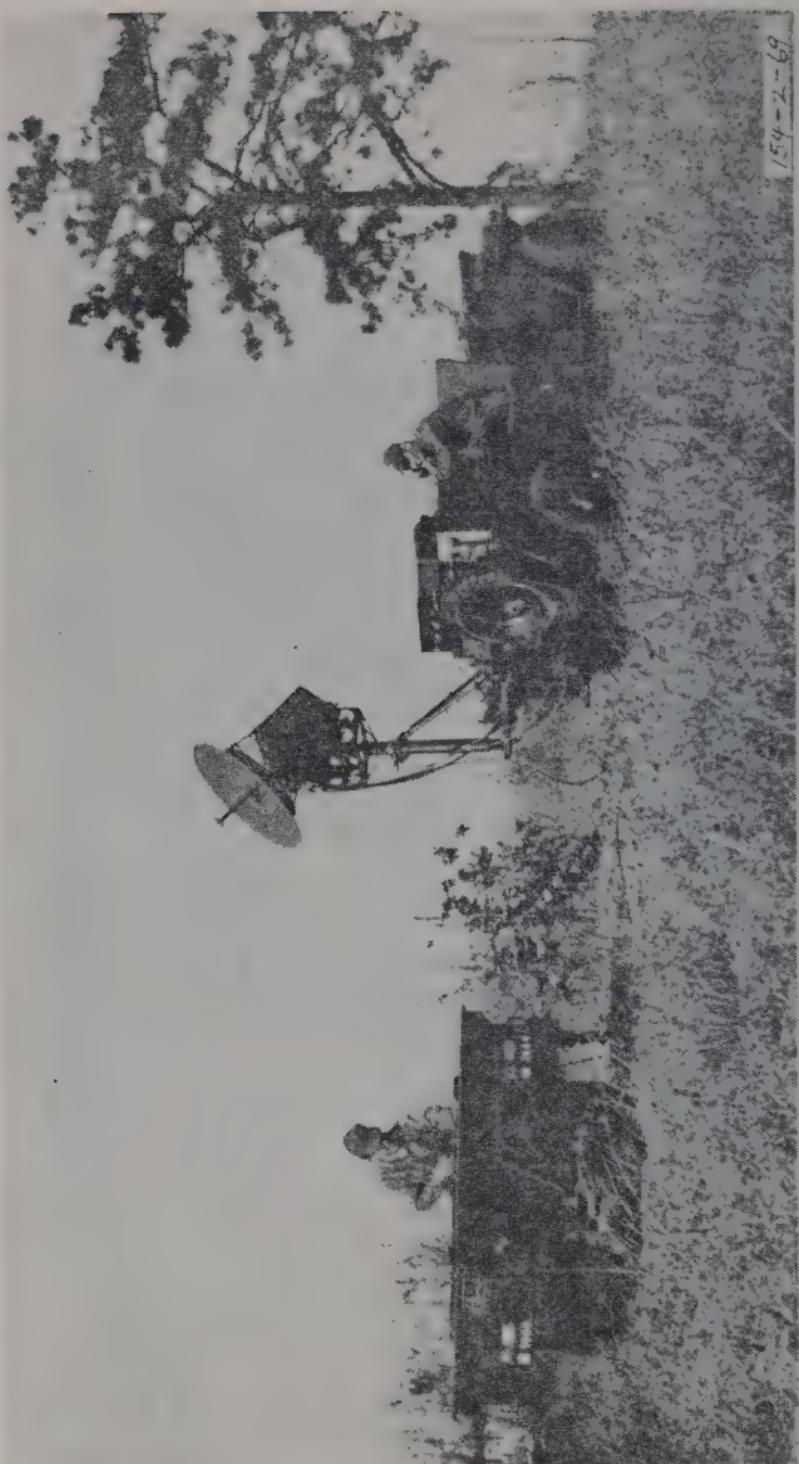
RADIO TERMINAL, SATELLITE COMMUNICATIONS (UMF) AN/TTR-32

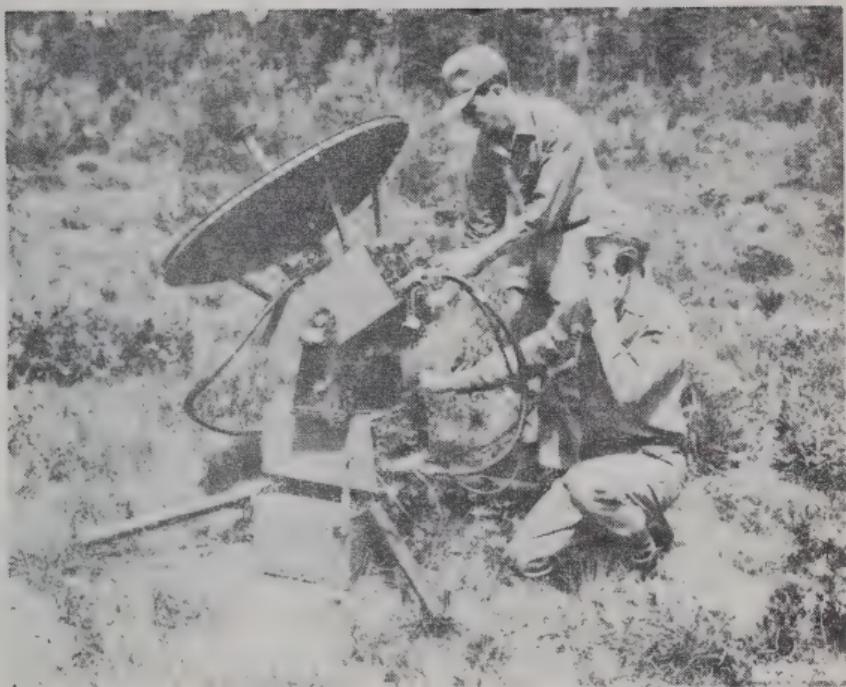


RADIO TERMINAL, SATELLITE COMMUNICATIONS (SHF) AN/TSC-80

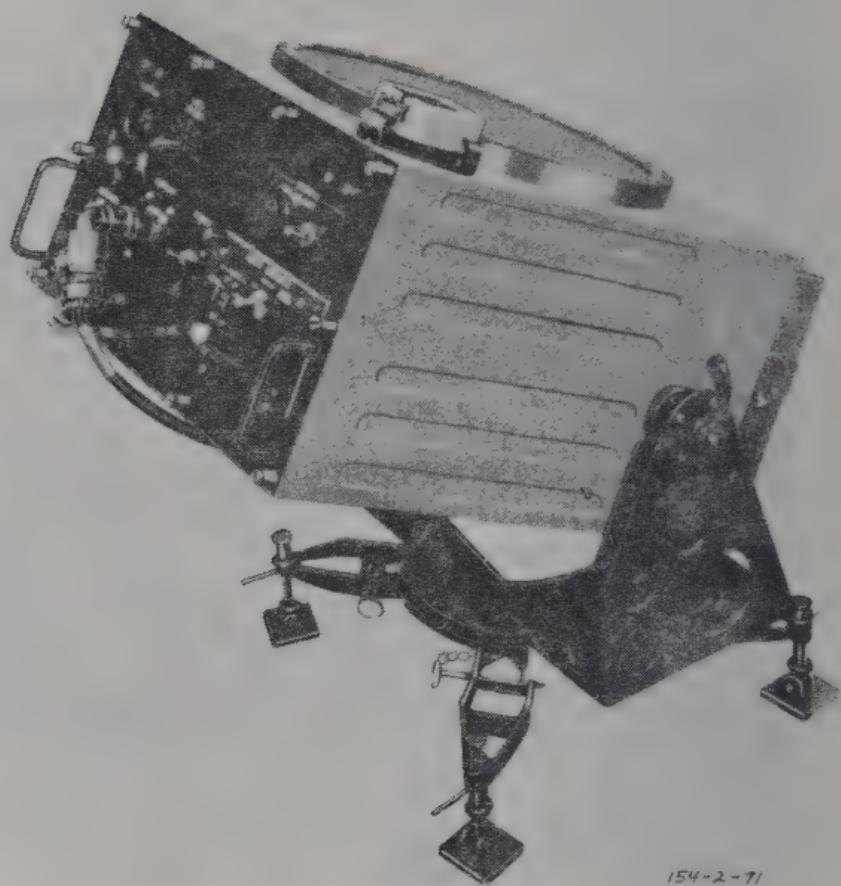
RADIO TERMINAL, SATELLITE COMMUNICATIONS (SHF) AN/MSC-57

154-2-69





RADIO TERMINAL, SATELLITE COMMUNICATIONS (SHF) AN/TSC-79



154-2-71

RADIO TERMINAL, SATELLITE COMMUNICATIONS (SHF) AN/TRR-30

# RADIO TERMINAL SATELLITE COMMUNICATION, AN/MSC-60, HEAVY TRANSPORTABLE (HT)

STATUS: Developmental FSN:

REF: DCA Satellite Communications Reference Data Handbook

## GENERAL INFORMATION

The AN/MSC-60 is a transportable terminal designed for semifixed installation with recovery (disassembly/reassembly) capability. It will require a prepared site and about 45 days to install. It will be employed as a nodal terminal under Phase II of DSCS. The antenna is 60 feet across, similar to that of the AN/FSC-9.

## TECHNICAL CHARACTERISTICS

Frequency Range: Transmit 7.9 to 8.4 GHz  
(5 to 9 separate carriers)  
Receive 7.25 to 7.75 GHz  
(9 to 12 receive carriers)

Type service: Will depend on multiplex systems used.

Baseband: 170 or 500 MHz

Input devices: 70 to 700 MHz wideband

Transmitter power: 3 KW and 8 KW

Planning range: up to 9000 statute miles

Power required: 120 V at 50/60 Hz, 300 KW

Weight: 400,000 lbs



# RADIO TERMINAL SATELLITE COMMUNICATIONS, AN/MSC-61 MEDIUM TRANS- PORTABLE (MT)

STATUS: Developmental FSN:

REF: DCA Satellite Communications

Reference Data Handbook

## GENERAL INFORMATION

The AN/MSC-61 is the medium weight counterpart of the AN/MSC-60 terminal, but it uses an antenna similar to that used with the AN/TSC-54. The AN/MSC-60 and AN/MSC-61 have interchangeable components, but the AN/MSC-61 will not have as much redundant equipment, and fewer RF carriers.

## TECHNICAL CHARACTERISTICS

Frequency range: Transmit 7.9 to 8.46 Hz  
(3 separate carriers)

Type service: Will depend on multiplex system used.

Baseband: 500 MHz or 170 MHz

Input devices: 70 to 700 MHz wideband systems

Transmitter power: 3 KW and 8 KW

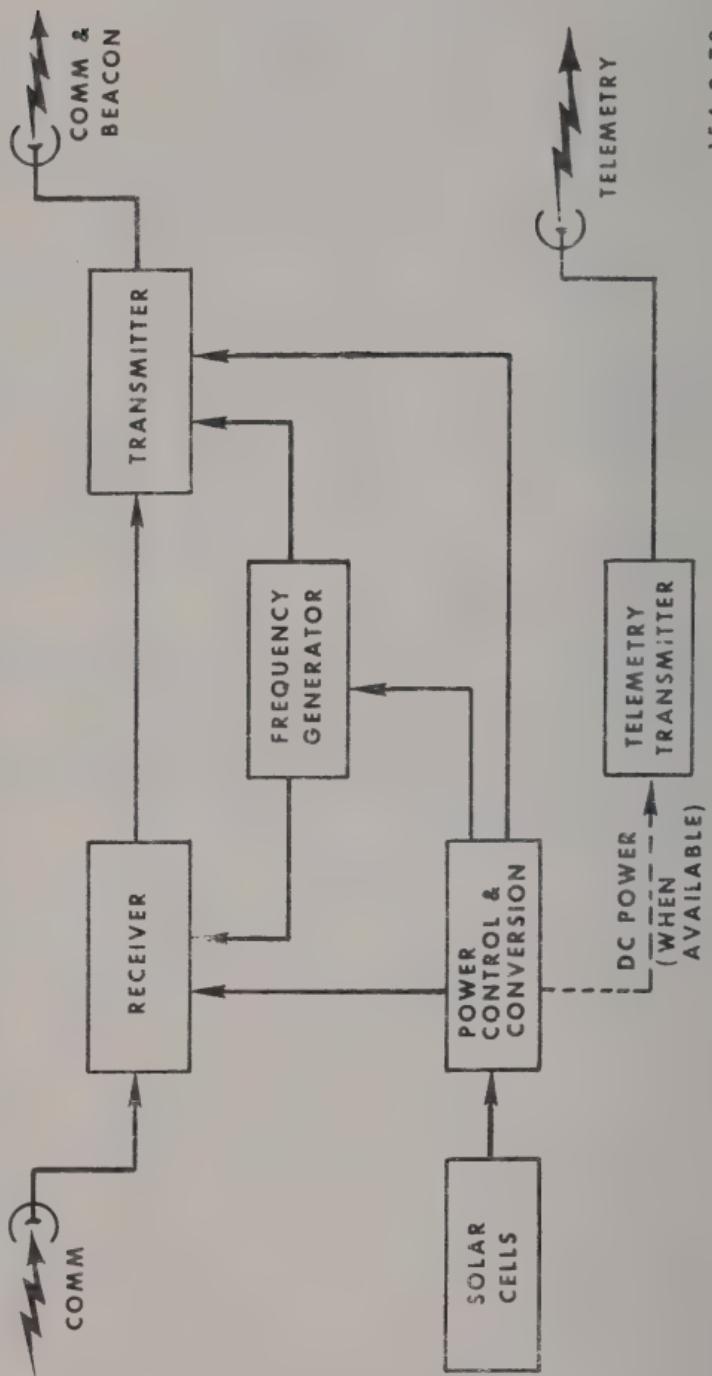
Planning range: Up to 9000 statute miles

Power required: 208/120 V at 50/60 Hz, 160 KW

Weight: 100,000 lbs

# COMMUNICATIONS SATELLITE ELECTRONICS

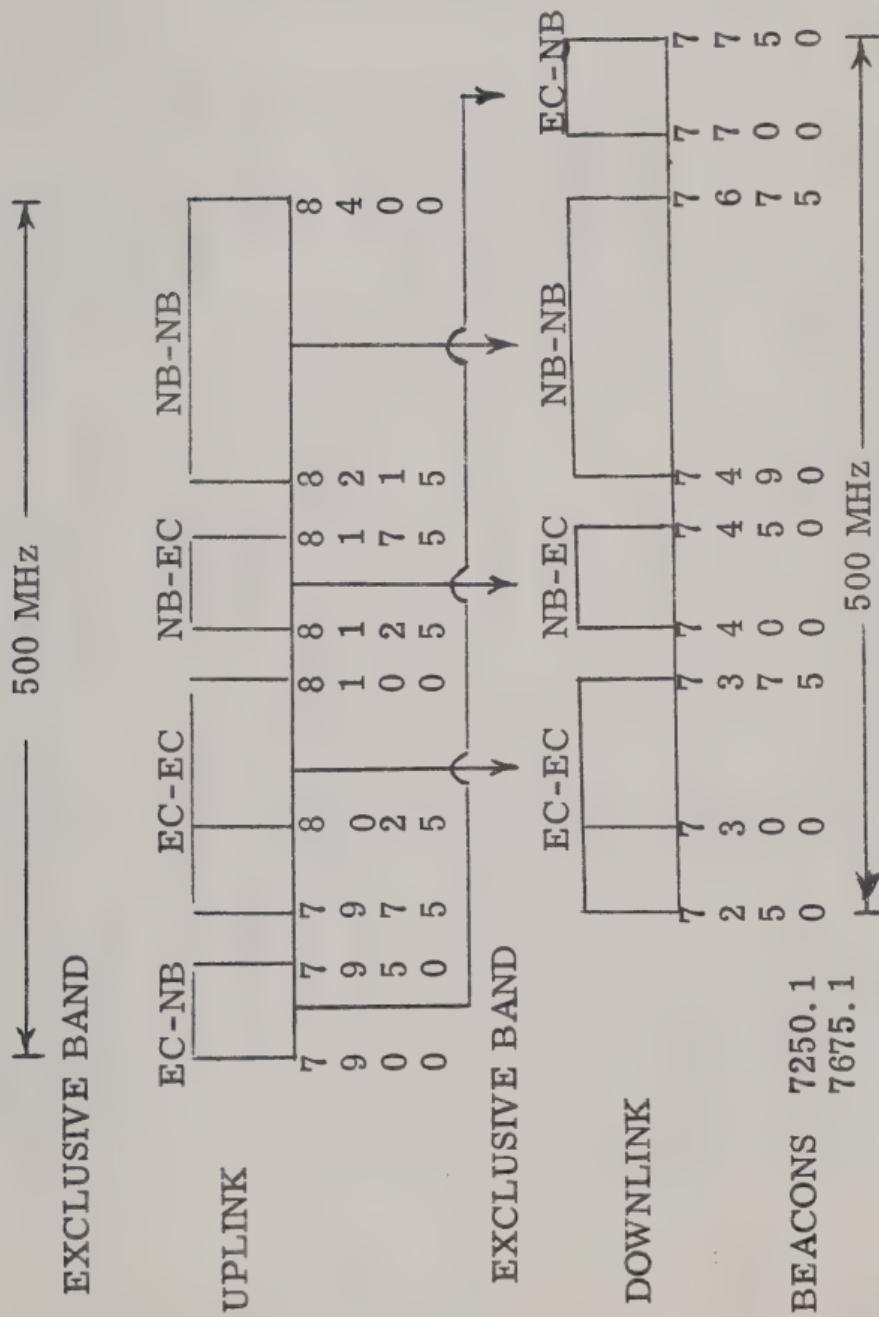
COMMUNICATIONS SATELLITE (SIMPLIFIED BLOCK DIAGRAM-DSCS TYPE)



154-2-73

# COMMUNICATIONS SATELLITE FREQUENCIES

## DSCS Phase II Satellite Frequency Translation Plan



DSCS PHASE I ACCESS FREQUENCIES

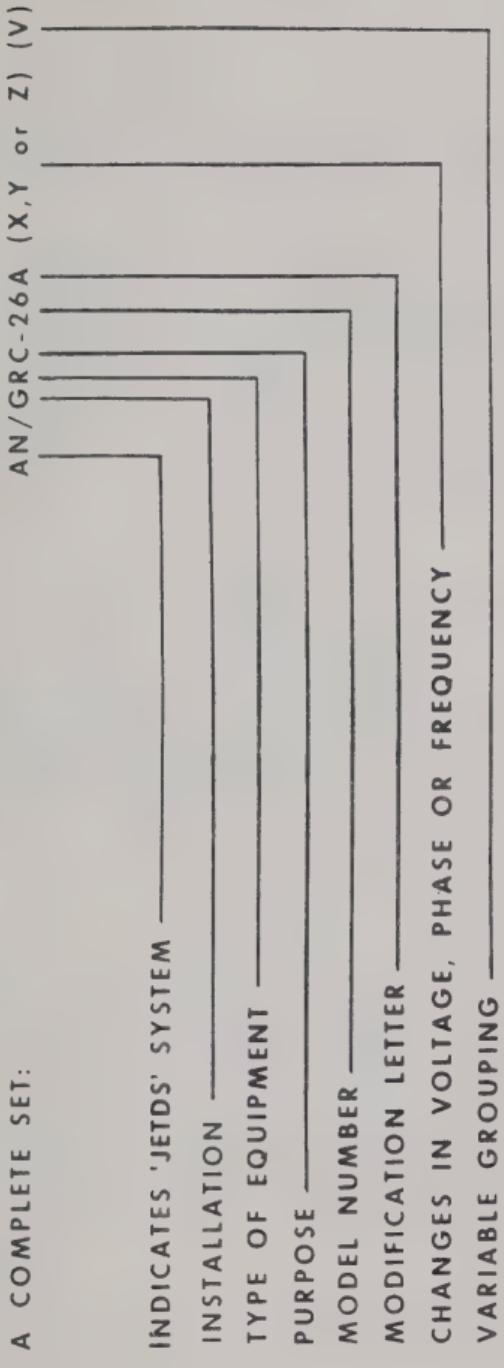
Satellite RF Access Channel	Frequency (MHz)	
	Uplink (Receive)	Downlink (Transmit)
1	7,267.0250	7,985.7450
2	7,271.7125	7,990.4325
3	7,277.9625	7,966.6825
4	7,285.7550	8,004.4950

TACCSAT FREQUENCIES (MHz)

Purpose	Uplink	Downlink
SHF Communications	7977.5 to 7987.5	7252.5 to 7262.5
SHF Beacon	-----	7298.5
UHF Communications	302.5 to 312.5	249.3875 to 249.8125
UHF Beacon	-----	254.1

## APPENDIX A. THE JOINT ELECTRONICS DESIGNATION SYSTEM (JETDS)

### 1. A COMPLETE SET:



2. SAMPLE OF A COMPONENT  
USED WITH A PARTICULAR SET:

C-808/GRC-26A

3. SAMPLE OF A COMPONENT  
NOT USED WITH A PARTICULAR SET:

S-69/GRC

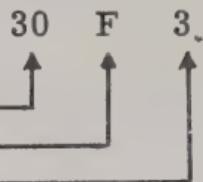
4. TABLE OF SET OR EQUIPMENT INDICATOR LETTERS

INSTALLATION	TYPE OF EQUIPMENT	PURPOSE
A - AIRBORNE	A - INVISIBLE LIGHT, HEAT RADIATION	A - AUXILIARY ASSEMBLIES
B - UNDERWATER	B - PIGEON	B - BOMBING
C - AIR TRANSPORTABLE	C - CARRIER	C - COMMUNICATIONS
D - PILOTLESS CARRIER	D - RADIAZ	D - DIRECTION FINDING
F - FIXED	E - NUPAC	E - EJECTION RELEASE
G - GROUND, GENERAL	F - PHOTOGRAPHIC	G - FIRE CONTROL
K - AMPHIBIOUS	G - TELEGRAPH OR TELETYPE	H - RECORDING
M - GROUND, MOBILE	I - INTERPHONE AND P. A.	L - SEARCHLIGHT CONTROL
P - PACK, PORTABLE	J - ELECTRO-MECHANICAL	M - MAINTENANCE AND TEST ASSEMBLIES
S - WATER SURFACE CRAFT	K - TELEMETRY	N - NAVIGATIONAL AIDS
T - GROUND, TRANSPORTABLE	L - COUNTERMEASURES	P - REPRODUCING
U - GENERAL UTILITY	M - METEOROLOGICAL	Q - SPECIAL OR COMBINA- TION OF PURPOSES
V - GROUND, VEHICULAR	N - SOUND IN AIR	R - RECEIVING
W - WATER, SURFACE AND UNDERWATER	P - RADAR	S - DETECTING RANGE BEARING
	Q - SONAR	T - TRANSMITTING
	R - RADIO	W - CONTROL
	S - SPECIAL TYPES	X - IDENTIFICATION AND RECOGNITION
	T - TELEPHONE (WIRE)	
	V - VISUAL	
	W - ARMAMENT	
	X - FAX OR TV	
	Y - DATA PROCESSING	

## APPENDIX B. TYPE OF SERVICE AND OPERATION EXPLAINED

### 1. Types of Service:

Indicates bandwidth in kilohertz  
Indicates type of modulation  
Indicates type of intelligence



### Types of Service Indicators:

<u>Modulation</u>	<u>Intelligence (partial listing)</u>
A-Amplitude	0 - None
F-Frequency or phase	1 - Telegraphy (CW, FSK, NSK) 2 - Modulated CW (MCW)
P-Pulse	3 - Telephone (voice) 3a - Single sideband, reduced carrier 3b - Two independent sidebands, reduced carrier 3h - Single sideband, full carrier 3j - Single sideband, suppressed carrier 4 - Facsimile 5 - Television 9 - Composite, or not otherwise covered

### 2. Types of Operation:

- Duplex (radio), full duplex or FDX (cable):  
Simultaneous operation in opposite directions.  
Transmitting and receiving over two frequencies.
- One half duplex, half duplex or HDX:  
System arranged to permit operation in either direction but not simultaneously, with a break-in capability.

- One way reversible: Operation in one direction at a time without a break-in capability.  
Utilizes one radio frequency.



## APPENDIX C. RADIO DATA

TABLE 1. RF TRANSMISSION CHARACTERISTICS

Band	Range (Note)		Power reqd	Antenna length
	Day	Night		
VLF	Long	Long	Ex-tremely high	Very long
LF	Long	Long	Very high	Long
MF	Medium	Long	High to medium	Long
HF (3-10 MHz)	Short to long	Medium to long	Medium	Medium
HF (10-30 MHz)	Long	Medium to long	Low	Short
VHF	Short	Short	Low	Very short
UHF, SHF, and EHF	Line of sight (RLOS)	Line of sight (RLOS)	Low	Very short

Note: Long range: Over 1,500 miles. Medium range: 200 to 1,500 miles. Short range: Under 200 miles. Line of sight: Under 50 miles.

TABLE 2. THE RADIO FREQUENCY SPECTRUM

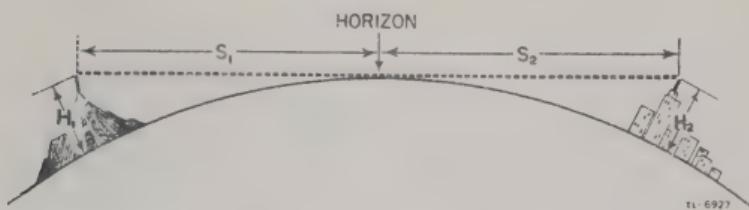
Frequency	3 kHz	30 kHz	300 kHz	3000 kHz	3000 MHz (3MHz)	3000 MHz (3GHz)	3000 MHz (3GHz)	3000 GHz	3000 GHz
Wave length	30km	3km	300m	30m	3m	30cm	3cm	3cm	.3cm
Band designation	VLF	LF	MF	HF	VHF	UHF	SHF	EHF	
C-2 Band no.	4	5	6	7	8	9	10	11	
	kHz - Kilohertz	GHz - Gigahertz	km - Kilometers	cm - Centimeters					

kHz - Kilohertz  
 MHz- Megahertz  
 GHz - Gigahertz  
 km - Kilometers  
 cm- Centimeters

Legend:

VLF - Very low frequency  
 LF - Low frequency  
 MF - Medium frequency  
 HF - High frequency  
 VHF - Very high frequency  
 UHF - Ultra high frequency  
 SHF - Super high frequency  
 EHF - Extremely high frequency

TABLE 3. HORIZON AND LINE-OF-SIGHT DISTANCES FOR VHF ANTENNAS



$$S \text{ (vhf distance to horizon)} = 4.12 \sqrt{H}$$

S is in kilometers, H is in meters.

Line-of-sight distance between two antennas:

$$S_1 + S_2 = 4.12 (\sqrt{H_1} + \sqrt{H_2})$$

$H_1 = H_2$ (Note 1)	$S_1 = S_2$ (Note 2)	$S_1 + S_2$ (Note 3)
Meters	Kilometers	Kilometers
1	4.12	8.24
2	5.85	11.7
5	9.23	18.5
10	13.0	26.0
50	29.1	58.2
100	41.2	82.4
500	92.3	185
1,000	130	260

Notes: 1. In the chart above, the heights of the antennas above ground are assumed to be equal ( $H_1 = H_2$ ); however,  $H_1$  and  $H_2$  may vary at actual antenna sites.

2. Horizontal distance.
3. Line-of-sight distance.

TABLE 4. TYPICAL 1/2-WAVE  
ANTENNA LENGTH FORMULAS

Frequency (MHz)	Antenna length (in feet)
2	234
3	156
4	117
5	94
6	78
7	67
8	59
9	52
10	47
11	43
12	39

Note: Refer to table 5 for other frequencies.

TABLE 5. WAVELENGTH, FREQUENCY,  
AND ANTENNA LENGTH FORMULAS

TO CONVERT WAVELENGTH ( $\lambda$ ) TO FREQUENCY:

$$\text{Freq (MHz)} = \frac{300}{\lambda \text{ (meters)}} \quad \text{or} \quad \frac{984}{\lambda \text{ (ft)}}$$

TO CONVERT FREQUENCY TO WAVELENGTH:

$$\lambda \text{ (meters)} = \frac{300}{\text{freq (MHz)}} \quad \text{or} \quad \lambda \text{ (ft)} = \frac{984}{\text{freq (MHz)}}$$

TO DETERMINE LENGTH OF 1/2-WAVE  
ANTENNA:

$$\text{Length (of 1/2-wave antenna in ft)} = \frac{468}{\text{freq (MHz)}}$$

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